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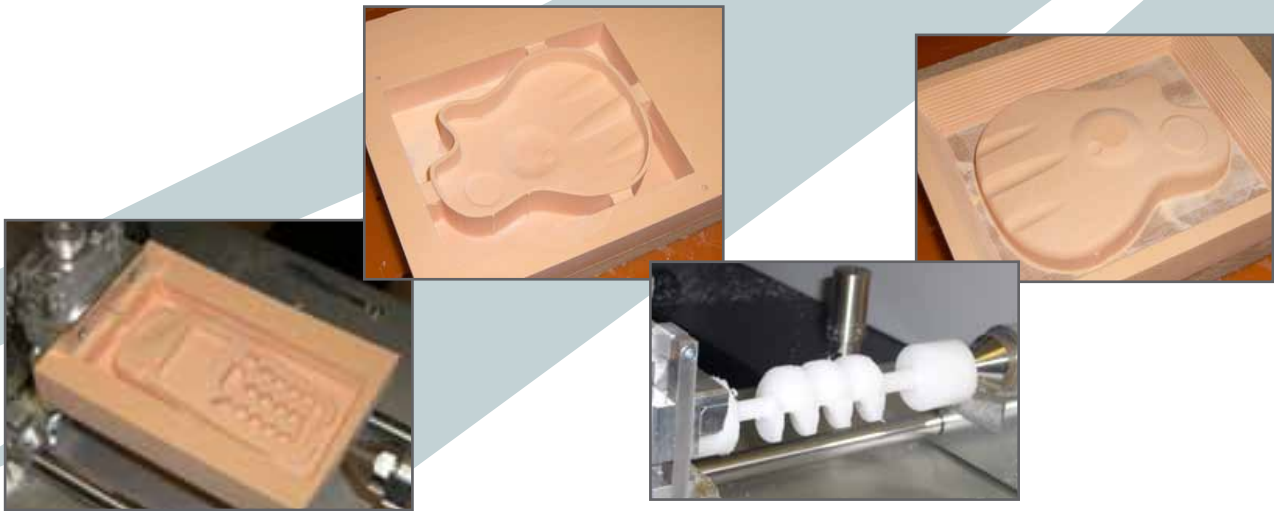
QUICKSTART

TO ROLAND

MDX-40

***and* MODELA PLAYER 4**

A Supplement Training manual with practical examples



 **Roland**



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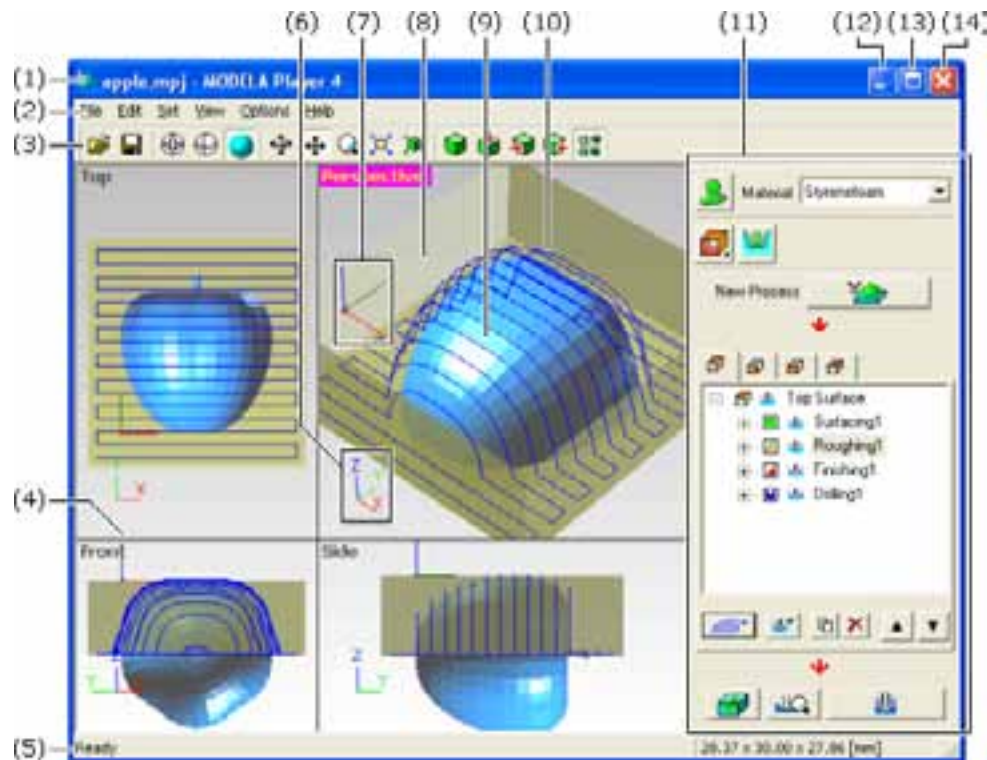
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Names and Functions of Screen



(1) Title Bar

The file name and program name are displayed here.
The window can be moved by dragging the title bar.

(2) Menu Bar

This runs the various commands for Modela Player 4.

(3) Toolbar

The toolbar is provided with buttons for running Modela Player 4 commands such as [Open] and [Save]. Moving the mouse pointer over a button displays a brief description of the button's function.

(4) Split Lines

These are displayed when in split view.
To change the split ratio of the window, drag the split lines in the view window.

(5) Status Bar

This shows the state of operation of Modela Player 4 and provides brief descriptions of commands.
It also displays the size of imported 3D model.

(6) Coordinate Axes

These show the orientations of the X, Y, and Z axes.

(7) Origin

These indicate the coordinate origin of the model.

(8) Modeling Form

This displays the cutting area (the range that the tool enters), including the margins and slopes that are necessary for cutting the model.

(9) Model

This displays the imported 3D data.

(10) Tool Path

This displays the path of tool movement as a blue line.
The tool path for the currently selected process is shown.
This is not displayed when the highest level of the process list (the project) is chosen. The same is true for a process for which no tool path has been created.

(11) Controller

The Controller is provided with button for cutting-process tasks extending from creating and editing to output, as well as Tree view. When no rotary axis unit is installed, processes are displayed for each cutting surface. Moving the mouse pointer over a button displays a brief description of the button's function.

(12) Minimize button

This shrinks the window to a button on the taskbar.

(13) Maximize Button / Restore Button

This expands the window to fill the screen.
To restore the window size, click again.

(14) Close Button

This ends the program.
If changes made to the file being edited have not been saved, a dialog box asking if you wish to save the changes is displayed.

Toolbar buttons



Open

You can open either 3D data in IGES, DXF (3D), STL, or XVL format, or existing project files. You can also open project files in MODELA Player version 3 or later.



Save

This command saves the project with its present name.



Wire Frame

This command displays the object using only a gridwork of lines.



Hide Lines

This command creates a wire frame on the surface and deletes the hidden lines at the back of the surface.



Rendering

This command adds color and shadowing to the displayed object.



Rotate

This command allows the model to be rotated by dragging with the mouse to change the angle of view.



Move

This command lets you move the model by dragging with the mouse. This is used to view parts of the model which lie beyond the edge of the window.



Zoom In / Out

This command enlarges or reduces the view of the model. Clicking the left mouse button shows an enlarged view with the point where you clicked at the center. You can select the area to zoom by dragging. Clicking the right mouse button shows a reduced-size view.



Fit to Screen

This command expands or reduces the size of the object shown to fill the screen. When you are in split view, this command affects only the active window. To apply it to all windows, hold down the [Ctrl] key and run the command.



Default View

This restores the point of view in effect just after you imported the model, and zooms the view in or out to fit it to the window. When you're in split view, this command affects only the active window. To apply it to all windows, hold down the [Ctrl] key and run the command.



Perspective

This displays objects drawn using the perspective projection method.



Top

This displays objects drawn on the XY plane using the parallel projection method.



Front

This displays objects drawn on the XZ plane using the parallel projection method.



Side

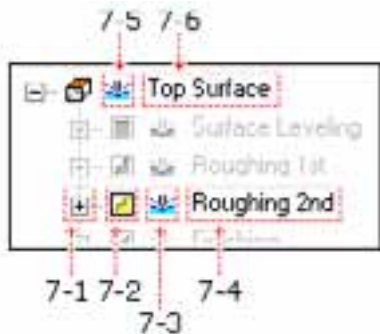
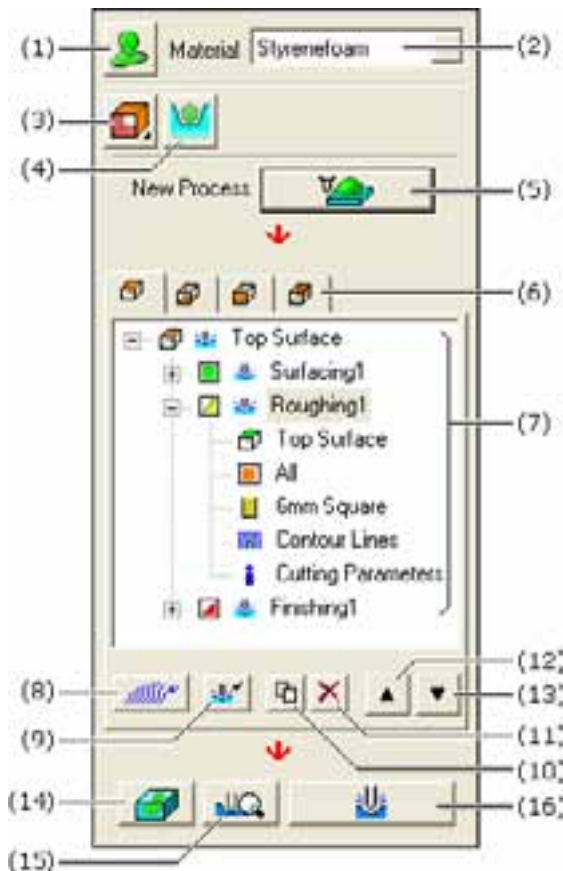
This displays objects drawn on the YZ plane using the parallel projection method.



Split

This splits the window into four parts and displays the Perspective, Top, Front, and Side views simultaneously.

Controller



(1) **Model** - makes the settings for the size and orientation of the imported 3D model.

(2) **Material** - chooses the composition of the workpiece. If the selection for the composition is not available, add it to the material library.

(3) **Number of Cutting Surfaces** - sets the number of cutting surfaces on the workpiece. You can choose one, two, or four surfaces.

(4) **Modeling Form** - makes the settings for the space around the model to provide approach paths for the tool. You can also set the depths and slope angles of the walls for each cutting surface.





(5) **New Process** - creates a new cutting process.

(6) **Cutting Surface Tab** - lets you choose the surface to cut. The process list for the selected cutting surface appears.

(7) **Process List** - displays a list of processes in tree format.

(7-1) Clicking this displays the setting items for the process. To change a setting, double-click the item.

(7-2) indicates the process type.

-  : Surface leveling
-  : Roughing
-  : Finishing
-  : Drilling

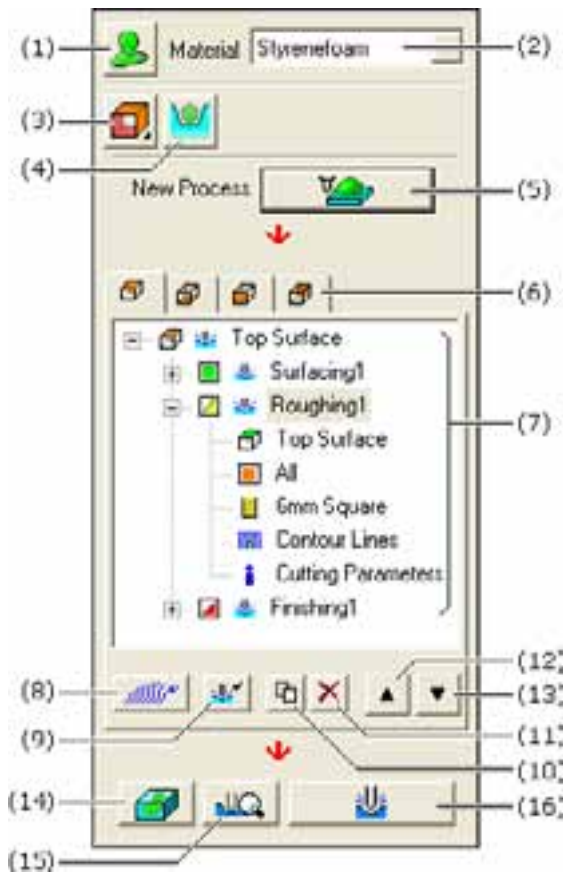
(7-3) indicates whether the cutting data is output.

(7-4) shows the name of process. To change the name, select the process, then click this again.



(7-5) indicates the presence or absence of cutting-data output for the cutting surface (or for the project). You can switch between presence or absence of data output for all processes that are presently displayed.

(7-6) shows the cutting surface or the project name.

Controller buttons (continued)



(8) *Create Tool Path* - creates a tool path for the selected process. If a path has already been created, it is created again.

(9) *Output Cutting Data* - switches data output on or off.
 -- Output
 -- No output

(10) *Duplicate Process* - duplicates a process and adds it as a new process. Only the settings are copied.

(11) *Delete Process* - deletes the specified process. You cannot delete more than one process at the same time.

(12) *Move Up* - moves the selected process up one line in the list. The output sequence for the cutting data changes.

(13) *Move Down* - moves the selected process down one line in the list. The output sequence for the cutting data changes.

(14) *Cutting Position* - makes settings the model's cutting position. The setting items differ depending on whether a rotary axis unit is present.

(15) *Preview Cutting* - lets you check the results of cutting on screen before you perform actual the cutting.

(16) *Cut* - outputs the cutting data and starts cutting.

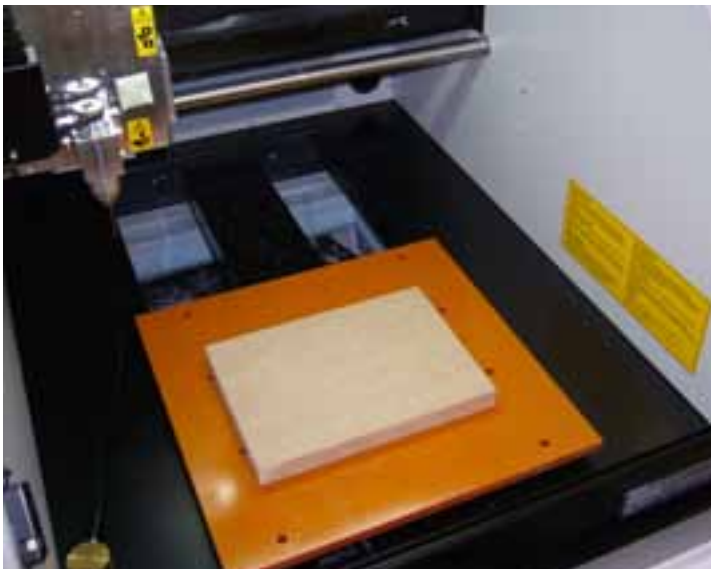
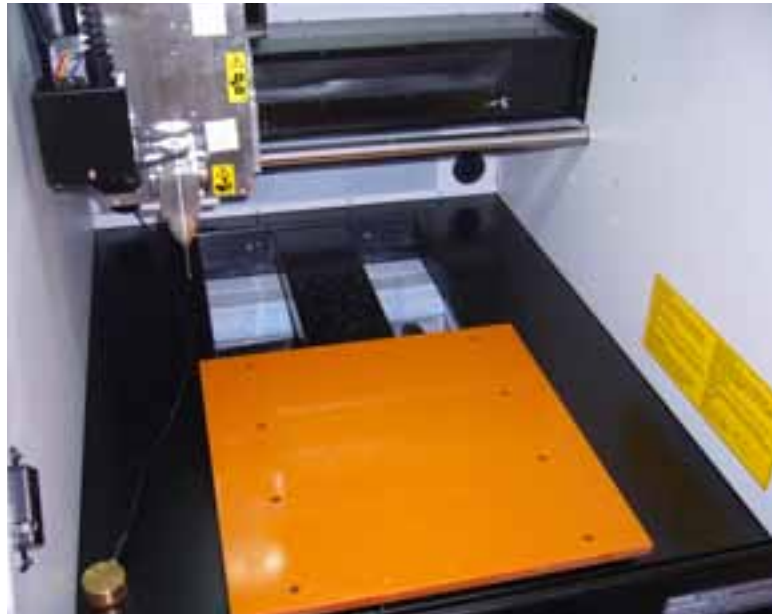
Material Mounting

STEP 1

Position protection base

First thing to do on **Roland MDX40** machine is to mount a base material on the work area -- the squarish orange board with 8 holes.

The reason is to protect this working area and to reduce wear and tear on the machine over time.



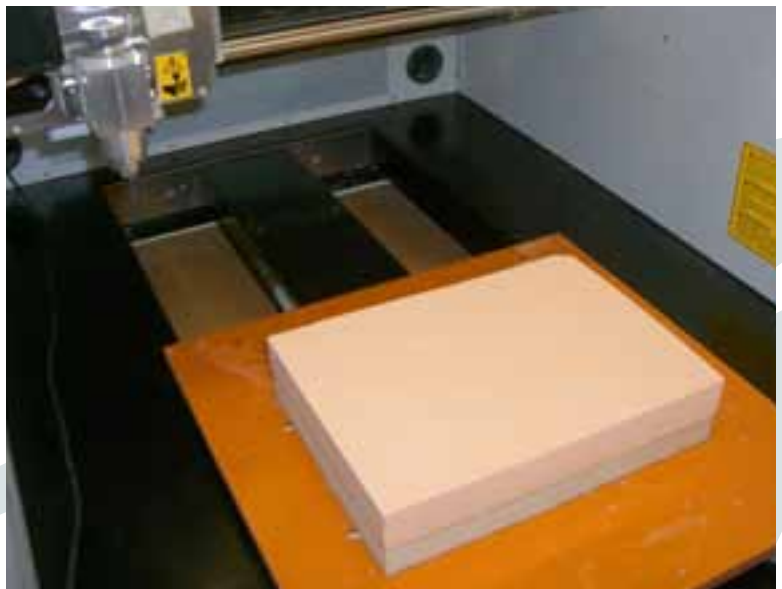
Find a firm and flat material such as hard wood to mount onto the working area.

Take sometime to measure and centre the mounting material if necessary. But you can place the mounting anywhere within the work area, wherever you decide.

Take reference from the photo shown on the left.

STEP 2 Position material

Place the actual material you have decided for the cutting to be mounted on top of the first layer of material. In this case, a chemical wood material has been suggested here. You can easily decide this on your own.



Tool Zeroing



STEP 3 Position sensor

This is a necessary step for any cutting to begin with.

Position the tool close to the material as shown.

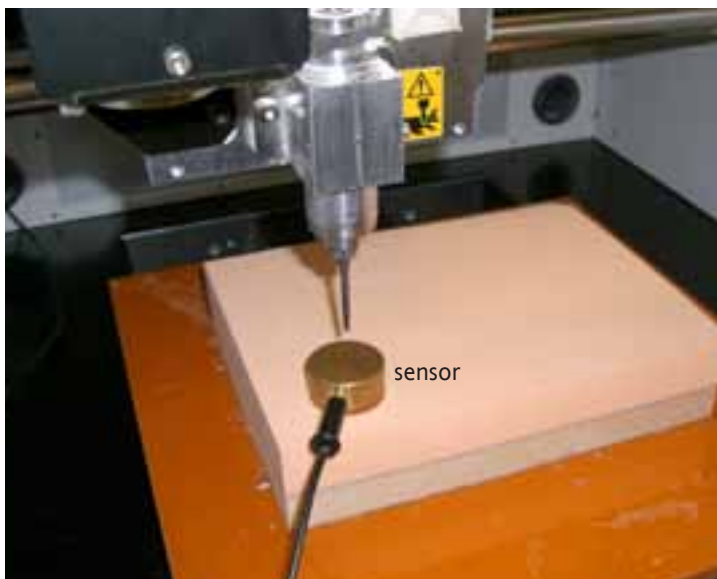
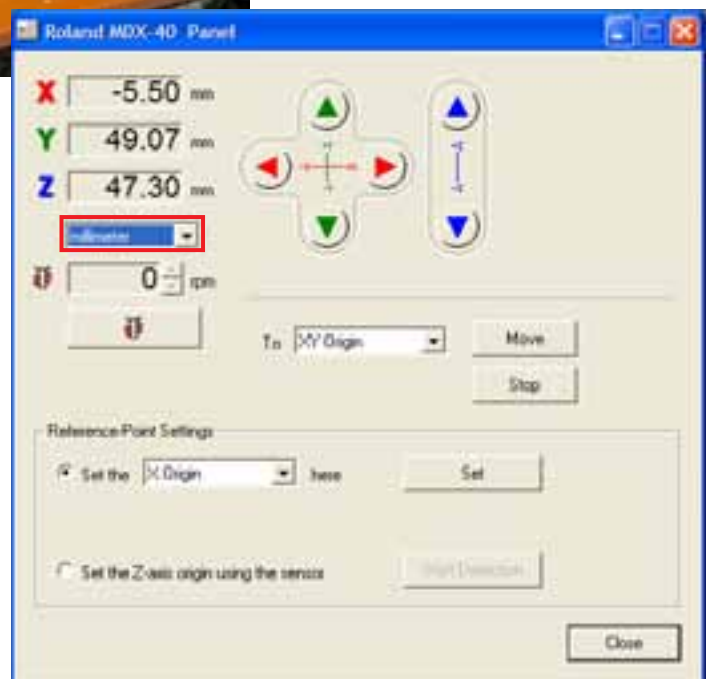
Place the sensor somewhere near the tool.

STEP 4

Choose unit of measurement

Go to , and select to bring up the Roland MDX-40 Panel. This is where you can use this to control and move the tool using the X, Y or Z axis.

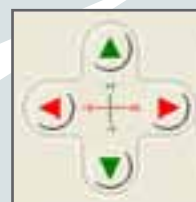
First, select **Millimeter** as the unit of measurement.



STEP 5 Position tool to sensor

This is a necessary step for any cutting to begin with.

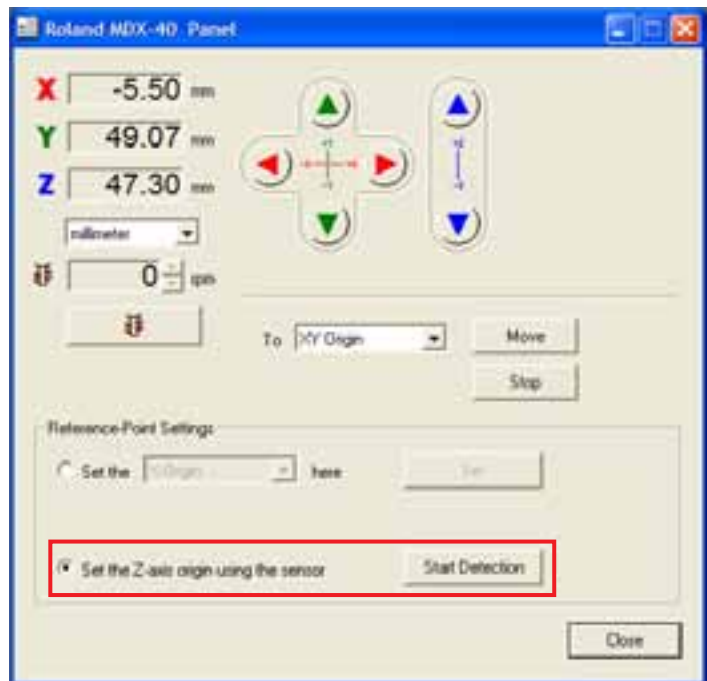
Position the tool above the **sensor** using the X and Y co-ordinate arrow keys as shown.



STEP 6 Detect Z-axis

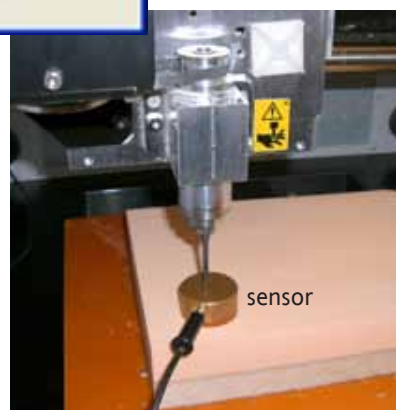
Next, check on the **Set the Z-axis origin using the sensor** at the *Reference-Point Settings* section.

Click on the **Start Detection** button.



A *Setup* dialog box appears, instructing you to place your cutting tool just above the sensor.

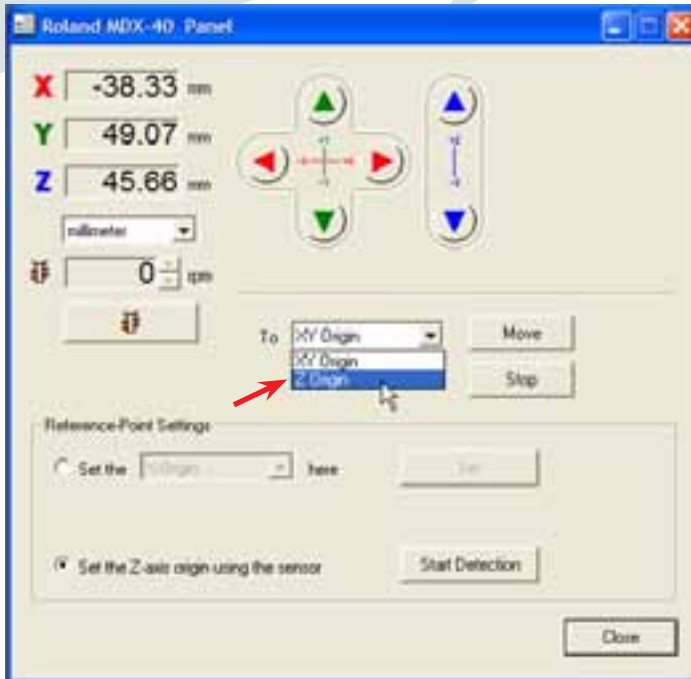
Click the **Continue** button.



STEP 7 Set Z origin

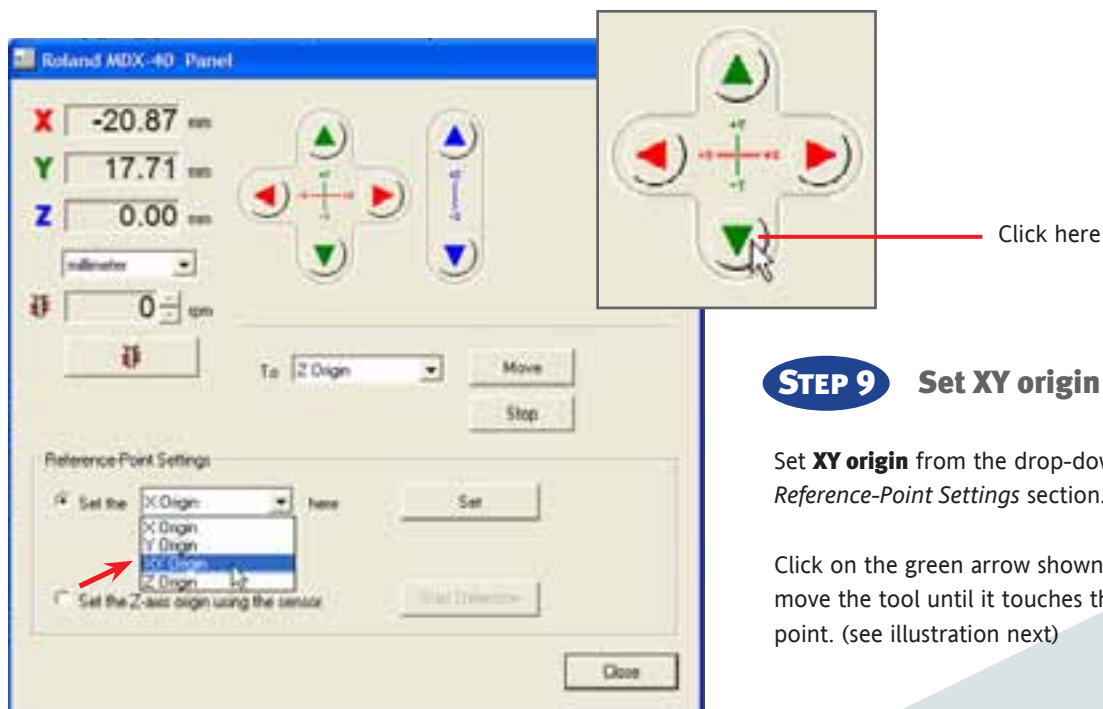
The software will now start to set the **Z-axis** origin for you. The tool will move down and detects the sensor a few times. Once detected, it will return back to the previous position. The dialog box will close automatically. *After this, remember to remove the sensor from the work piece as we DO NOT need it anymore.*

However, if the tool cannot correctly detects the sensor properly after a few times, simply click the **Quit** button to exit and try again.

STEP 8 Set Z origin (continued)

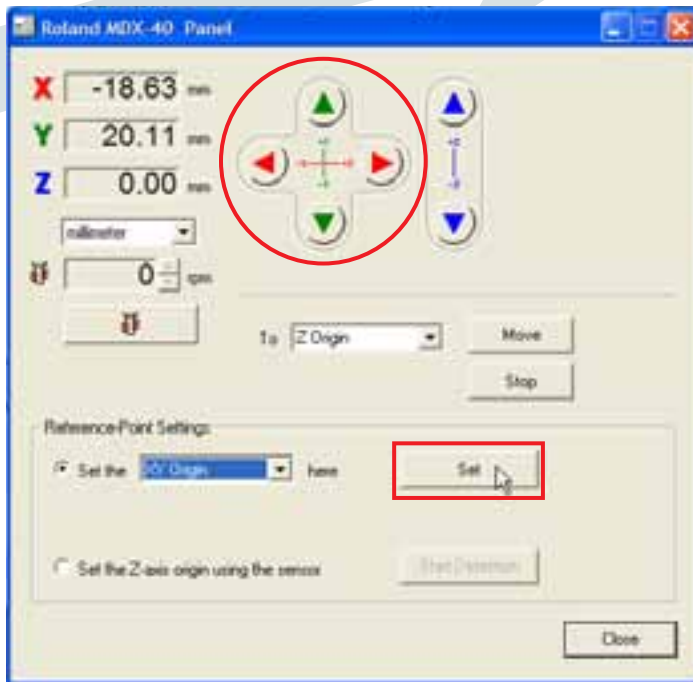
Select **Z origin** from *To* drop-down list.

Click the **Move** button.

**STEP 9 Set XY origin**

Set **XY origin** from the drop-down list at *Reference-Point Settings* section.

Click on the green arrow shown above to move the tool until it touches the origin point. (see illustration next)



STEP 10 Set XY origin (continued)

Then, click on the **Set** button next to the **XY origin** checked. Finally, we are done with setting the X, Y and Z axis of the cutting tool. Click on the **Close** button.

What is Modela Player 4?

Modela Player 4 is a computer-aided manufacturing (CAM) program for cutting machines from *Roland DG Corp.* It imports 3D data in common formats (IGES, DXF (3D), STL, or XVL), and outputs tool paths for cutting machines from *Roland DG Corp.**

Main Features of **MODEL A Player 4**

- Creation of multiple processes
- Support for square end mill, ball end mill, radius end mill, conical end mill, and drill tools
- Setting the cutting sequence
- Selection of cutting processes

*see **Appendix A** for more explanations



To understand better about how to operate Roland's MDX-40 machine using Modela Player 4, let's work on a new example.

Example 1 - Objective

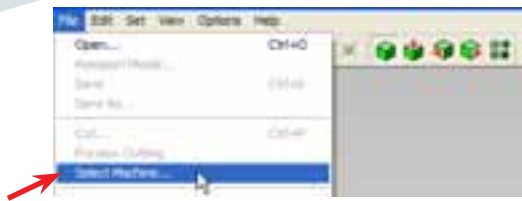


To cut out a guitar body without any shelling using Roland's MDX40 machine.

List of Items to Prepare for use

1. MDX-40 machine (Power up)
2. Example file *guitar_no_shell.stl*
(downloadable from Tutorials page, Freeform Digital website)
3. 1 piece of chemical wood cut to size (L200 mm x W150 mm x H23.23 mm)
4. 1 piece of wooden block cut to size (L200 mm x W150 mm x H25 mm)
- to be used for base support only
5. R1.5 Ball mill cutting tool
6. Double-sided tape

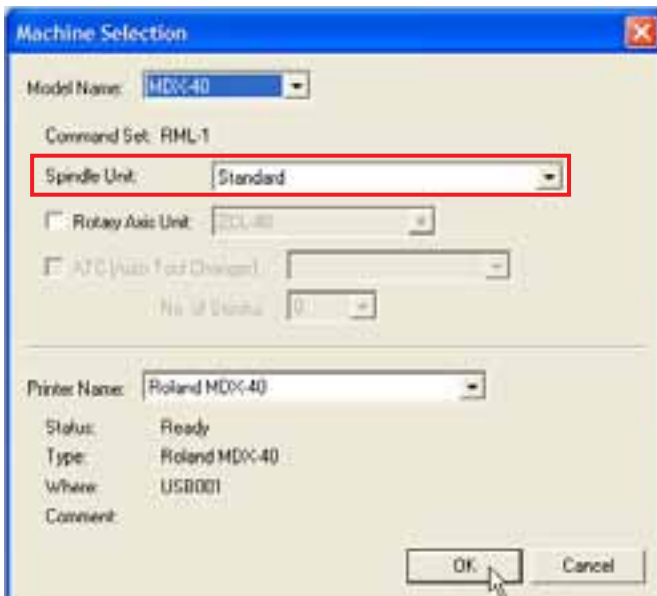
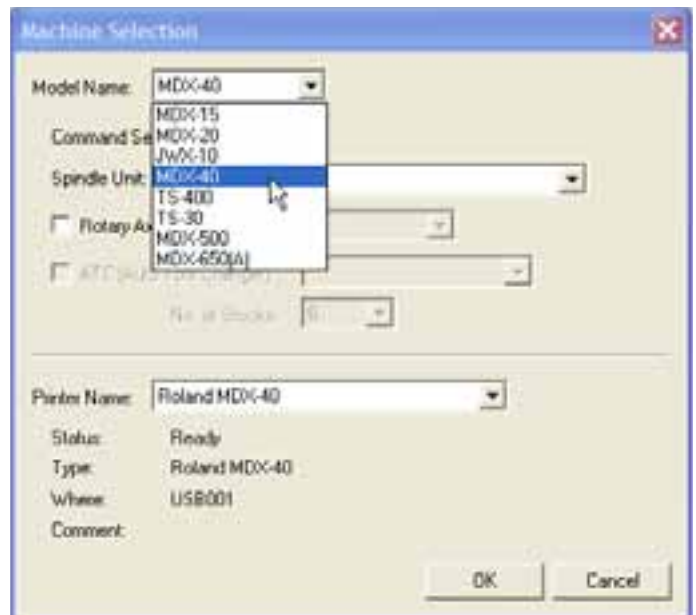
Example 1 - Guitar without Shelling



STEP 1 Select Machine

Under the menu at the top, go to **File > Select Machine...**

Select **MDX-40** from the **Model Name** drop-down list in the *Machine Selection* dialog box that appears.



Next, click on the *Spindle Unit* drop-down list, and choose **Standard**. Then, click **OK**.

STEP 2 Set Preferences

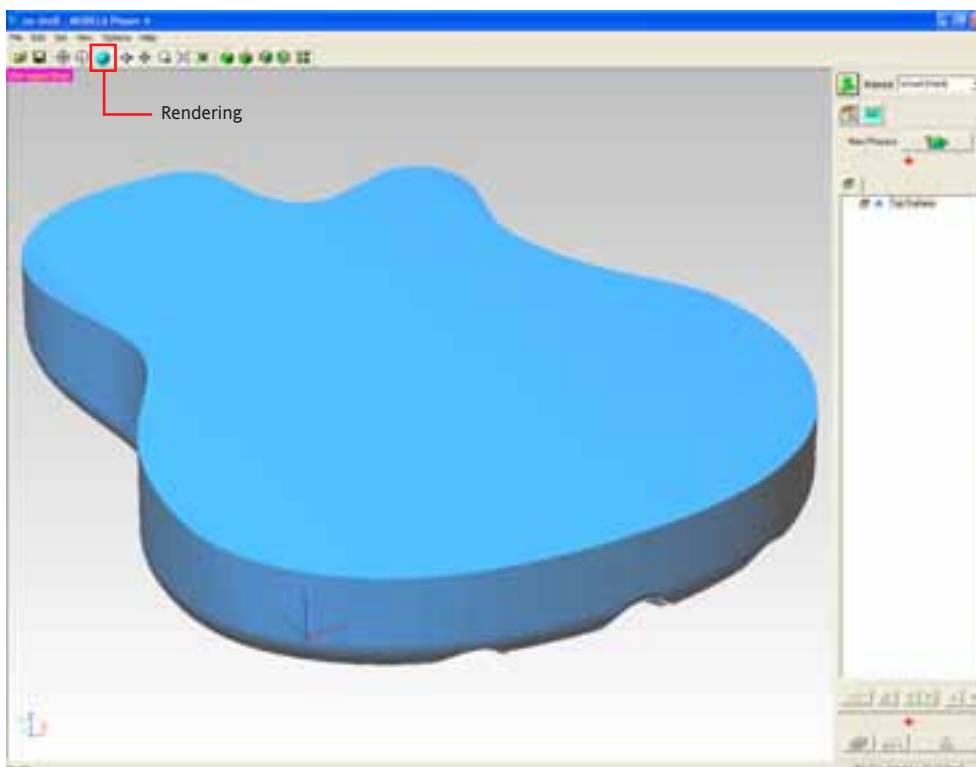
To configure the unit of measurement for our work, go to **File > Preferences...**



When the *Preference* dialog box pops up, check on **mm** for *Unit* on the left column, and select **OK** to close this box.



STEP 3 Open example file

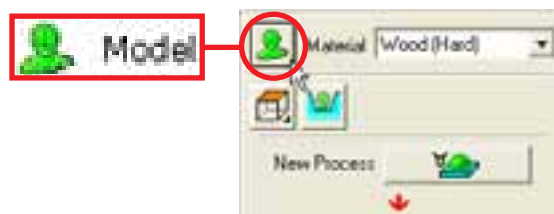


Locate and open up **guitar_no_shell.stl** from your folder on desktop.* Click on the *Rendering* button on the top menu to get the shading shown above.

*All examples used here are downloadable from Freeform Digital website.

STEP 4 Layout 3D model

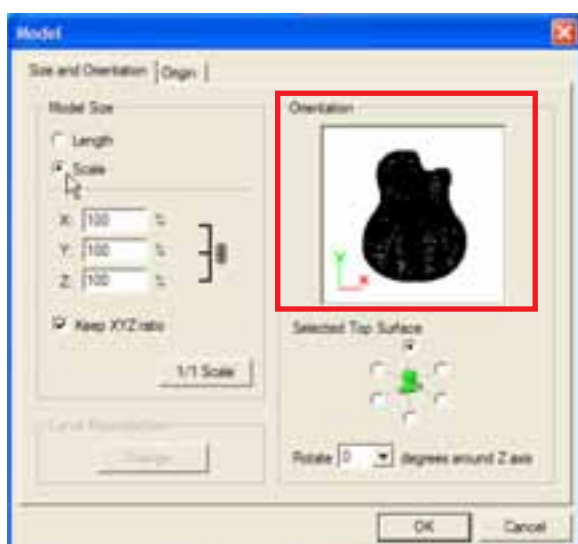
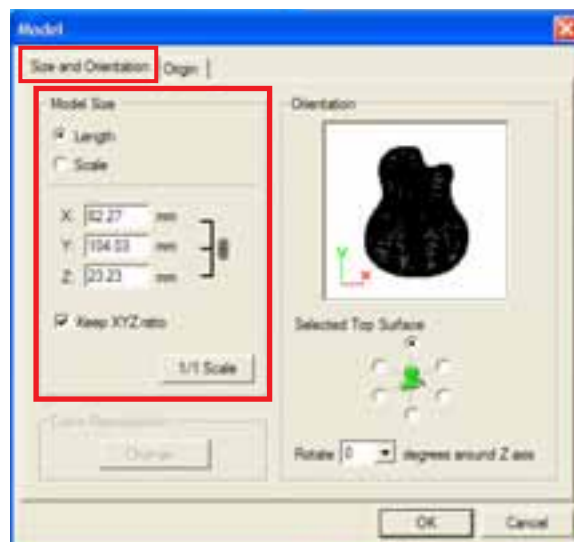
Located on the right side of the interface is a set of configuration options to prepare 3D models for cutting. First, click on the green man button labelled **Model**.



A *Model* dialog box pops up, presenting you with 2 tags - *Size and Orientation*, and *Origin*. Under the *Size and Orientation* tag, you will see a set of options. Select **Scale** option under *Model Size* to resize your model proportionately in percentages instead of using the **Length** option.

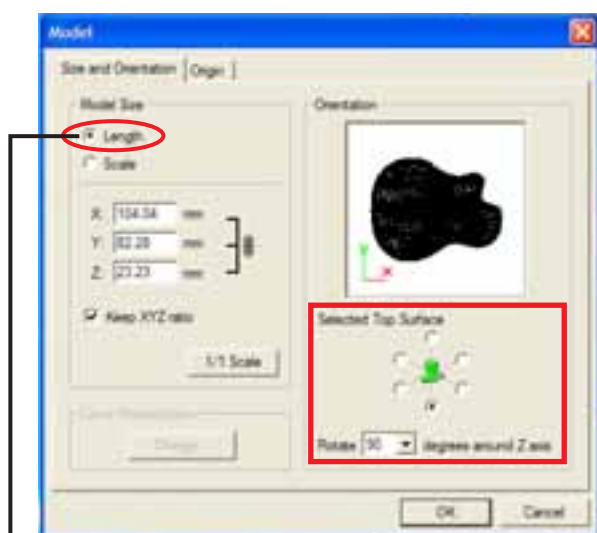
To enlarge or reduce the size while keeping the aspect ratios the same, select the **Keep XYZ ratio** check box. Unchecking it allows you to edit the values of X, Y and Z separately.

To go back to the original dimensions of the 3D data, click **1/1 Scale**.



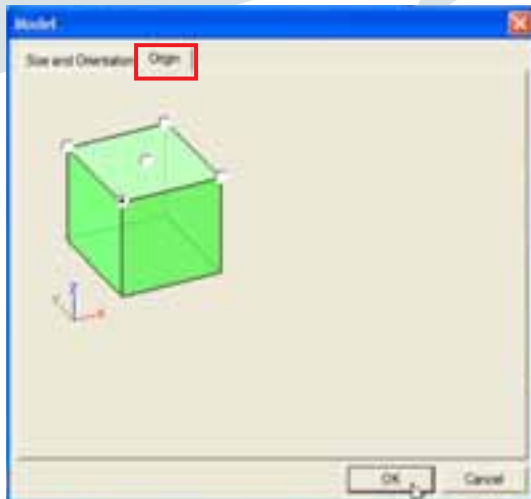
On the right side of the dialog is where we set the orientation of the model.

It specifies the top surface and orientation of the model. When you are performing single- or multiple-surface cutting, the top surface is the first surface cut.

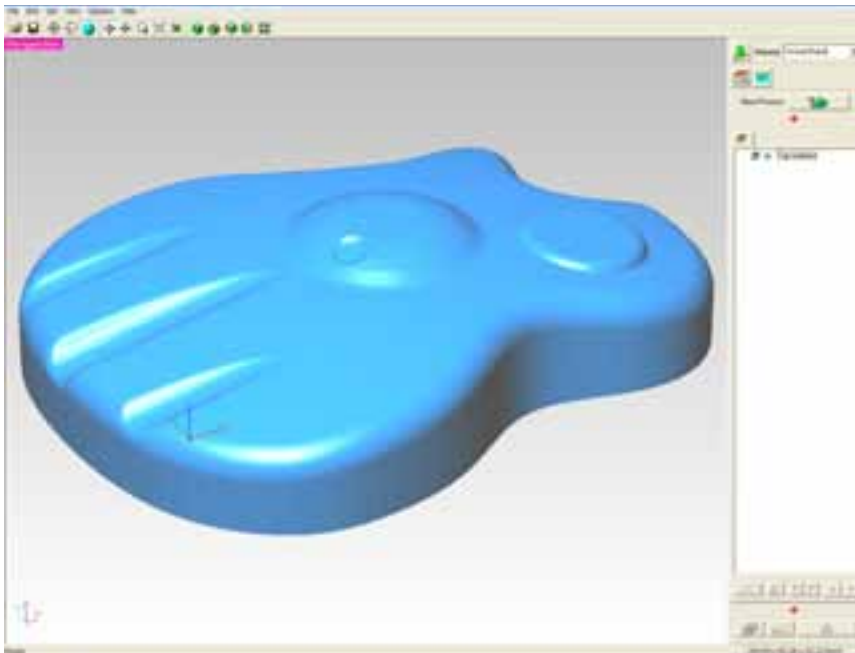


radio button

Change the *Model Size* back to **Length**. On the right side, under *Selected Top Surface*, you can check on to select an angle of rotation of the model by clicking on the radio buttons as shown. Then drop down the **Rotate** list to select **90** degrees for the angle.



Clicking on the next tag - *origin*. This sets the origin point for the model. Click **OK** to close.

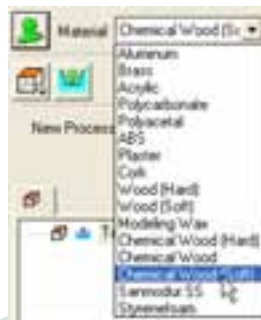


Model rotated as shown.

STEP 5 Choose material and surface

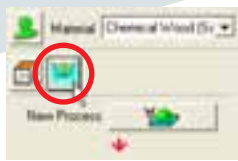



Next, click on **Material** drop-down list to select your material. Choose **Chemical Wood (Soft)**.



Click on **No. of Cutting Surfaces**. Select 1st surface to cut. (1st icon of the 3)

STEP 6 Forming model for cut



Click on the next button  **Modeling Form**. This makes the settings for the space around the model to provide approach paths for the tool.



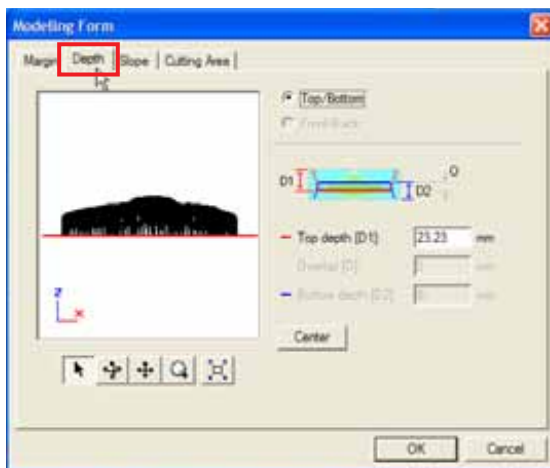
The *Modeling Form* dialog box displays 4 tags for you to edit your options.

Under the **Margin** tag:

Automatic - This automatically sets the margins around the model.

Manual - Make the settings for the margins you want around the model.

So choose **Manual**, input **5 mm** for a margin around the cutting of the model.



Choose the **Depth** tag.

Preview - This displays the cutting-depth locations.

It lets you check the depths to which the model is cut. You can also rotate, move, or zoom the view, or fit it to the screen. *

Top/Bottom, Front/Back allows you to choose the surface whose cutting depth you want to set. Change the depth by *dragging* the red line down all the way to the bottom.

Or you can set the cutting depth by inputting a value for **Top Depth**. You can make the setting for **Front/Back** when you are performing four-surface cutting.

*see **Appendix A** for more explanations



Tap on the **Slope** tag now.

When perpendicular walls are higher than the length of the blade, the tool does not reach bottom.

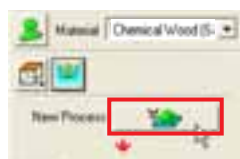
Adding slope to the walls enables approach by the tool. So *check* on **Make sloped** option. Input **20 degrees** for the **Top**.

Tap on **Cutting Area**. This shows the displays of the modeling form that you have already set. Click **OK** to close.



STEP 7 Define Surfacing on model

Continue next to click on the **New Process** icon. A **New Process** dialog box appears. This lets you choose the type of process.



Surfacing

This lightly cuts the surface of the workpiece to create a level surface.

Roughing

This cuts the workpiece to the approximate shape.

Finishing

This cuts the final shape of the model.

Drilling

This drills holes in the model and surrounding workpiece.

Let's start with surfacing on the material. So *check* on **Surfacing** option, and click **Next** to continue.



STEP 8 Choose cutting surface

This *Cutting Surface* page lets you choose the surface to cut.

Top / Bottom / Front / Back - lets you choose the cutting surface to select it.

Note that when there is only one cutting surface, no selections other than the top surface are available.

Click **Next** to continue.

STEP 9 Choose tool diameter

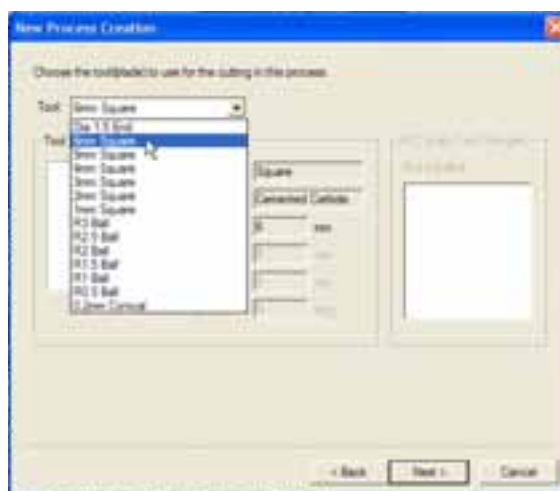
Drag down the **Tool List** to select **6mm Square** for the tool that we will be cutting.

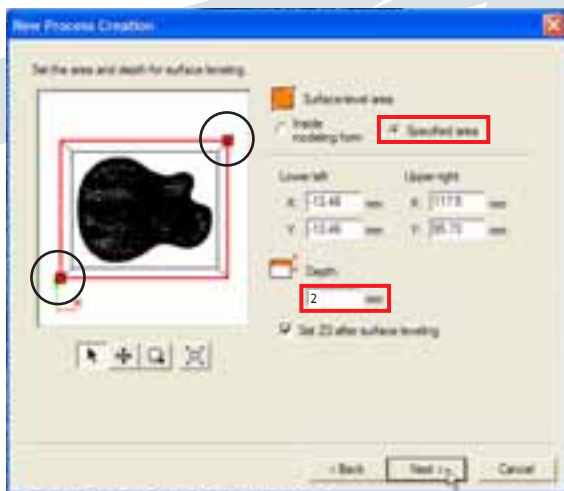
You cannot choose a tool for which no cutting parameters have for the material have been registered.

To register cutting parameters, quit this wizard temporarily, then go to **Options** and click **Register Cutting Parameters**.

Tool Specifications displays the specifications of the tool you have chosen.

Click **Next** to continue.





STEP 10 Set area & depth for Surfacing

In the next dialog, select **Specific area** to cut for *Surface-level area*. This allows you to define the area you want. Choose this when you want to perform surface leveling over an area broader than the modeling form or when you want to restrict the area. When you do this, the tool passes along the contours in the area.

Notice that 2 red squares will appear at 2 of the corners of the model selection. Dragging the squares will enable you to change the sizes of the surface area. The Depth option allows you to specify how deep the cut. In this case, enter a value that you want to surface off. Click **Next** to continue.



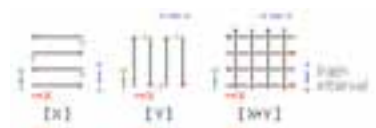
STEP 11 Set type of tool path

In the *Path Type* page, choose the pattern of the locus that the tool traces when it cuts into the workpiece. This affects the cutting time and the quality of cutting.

Scan Lines - creates a tool path parallel to the specified axis. The path is created in such a way that the outbound movement and return movement lie along the axis.

Select X for **Scan Lines**.

Click **Next** to continue.



STEP 12 Set cutting parameters

At the *Cutting Parameters* page, it makes the settings for the feed rate, cutting-in amount, and other cutting parameters. Changing the parameters changes the amount of cutting per unit of time.

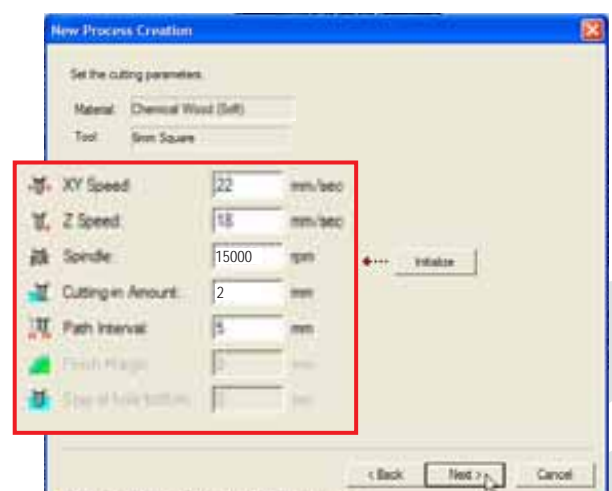
XY Speed / Z Speed - controls the movement speeds (feed rates) for the tool during cutting

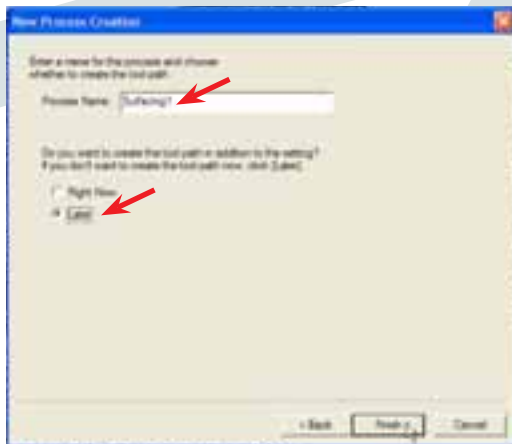
Spindle - controls the spindle rotating speed

Cutting-in Amount - the depth to which the tool cuts into the workpiece

Path Interval - allocates the interval between adjacent paths

Enter the values for each of the above as shown in the diagram. Click **Next** to continue.





STEP 13 Save Surfacing process

In the *Create Tool Path* page, enter a name to save your tool path. The name appears in the Controller process list.

Right Now - This creates the process together with the tool path. Tool-path creation may take some time.

Later - This creates only the process, without creating the tool path. Choose this when you want to postpone the processing time required to create the tool path, and concentrate on process creation process instead.

You can create the tool path after you have created the process.

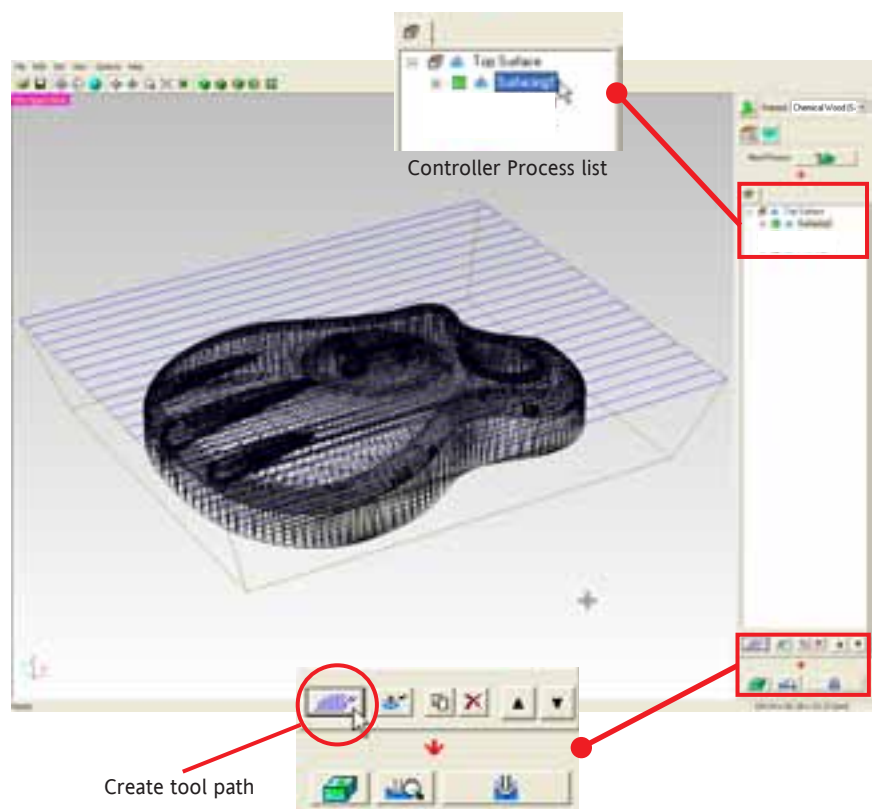
Name your **Process Name** as **Surfacing1** and choose **Later** option. Click **Finish** to close.

STEP 14

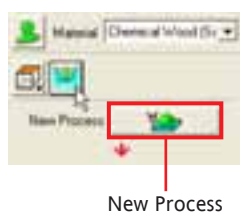
Create tool path

At this point, you should have a similar layout as shown. A tool path has been created for the guitar model without shelling. So in the Controller process list, you should see a **Surfacing1**.

Next, click on *Create tool path* tool to generate a path ready for cutting.



STEP 15 Define Roughing on model



Next, bring up the *New Process Creation* dialog box by selecting the *New process* icon as shown.

Since we have finished **Surfacing**, let's continue with **Roughing**. Note the change of the preview as you select different cutting methods.

Selected as shown and click **Next** to continue.



STEP 16 Choose cutting surface

This *Cutting Surface* page lets you choose the surface to cut.

Top / Bottom / Front / Back - lets you choose the cutting surface to select it.

Note that when there is only one cutting surface, no selections other than the top surface are available.

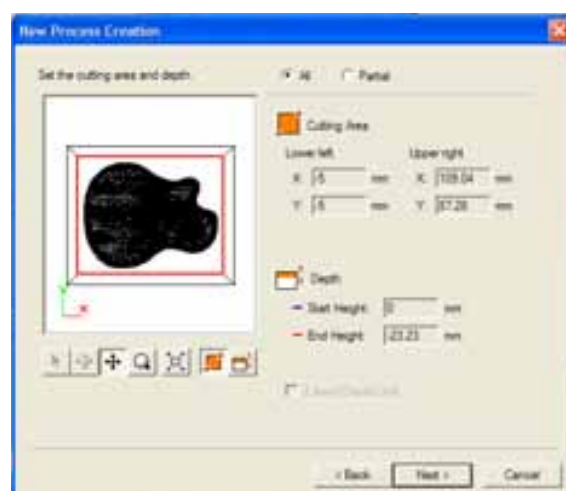
Click **Next** to continue.



STEP 17 Choose tool diameter

Choose **R1.5 ball mill** tool from the drop-down list for the cutting.

Click **Next** to continue.



STEP 18 Set area & depth for Roughing

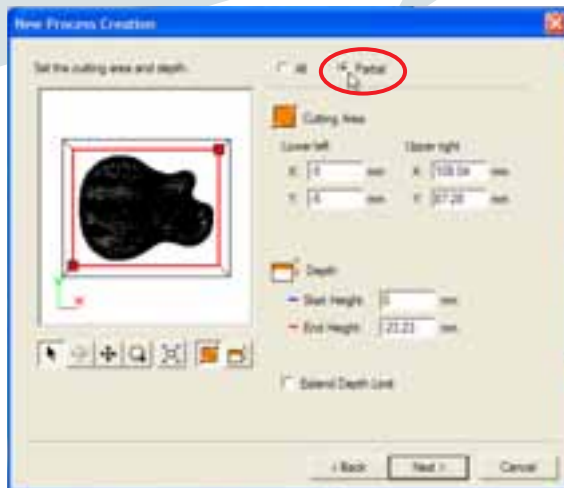
The settings in the *Cutting Area* dialog box is slightly different from the one in Surfacing. *

In setting cutting area and depth, we faced two cutting options: **All** or **Partial**.

All - This cuts the entire area of the specified cutting surface, including the modeling form.

Partial - This cuts a portion of the model. It makes it possible for you to cut just uncut areas or areas where cutting was insufficient.

*see **Appendix A** for more explanations

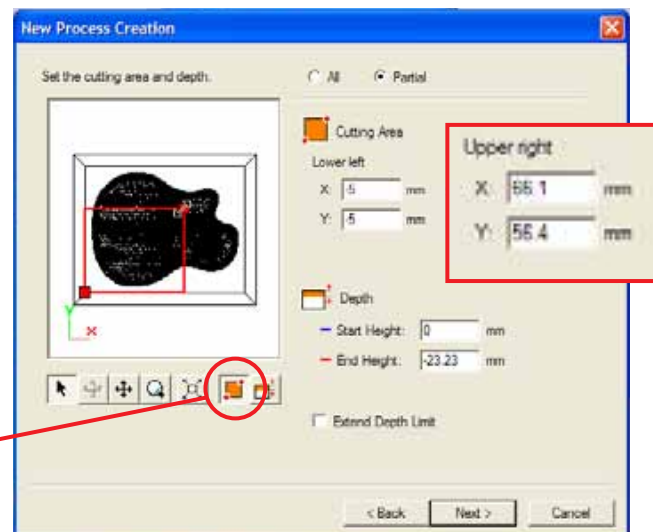


Select **Partial** option. Notice that when we select the **Partial** option, all the settings have become available for editing.

Also, 2 red squares appear in the *Preview* window. You can either click and drag the squares to move the dimensions or input values into the required fields for *Cutting Area* and *Depth*.

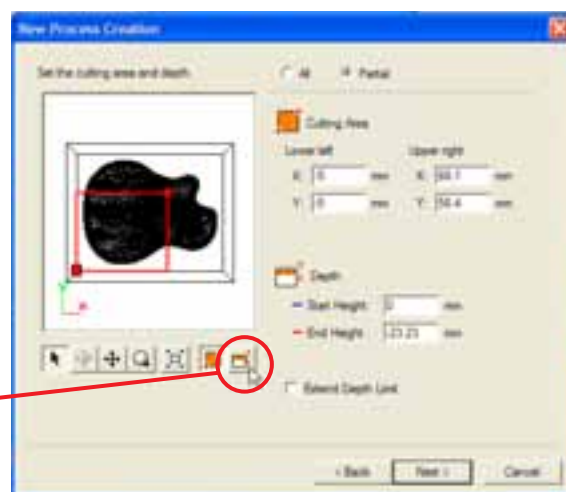
Input the values for *Upper right* of the Cutting Area OR drag the red squares as shown in the *Preview*, after clicking on the *Drag red pointer tool*.

 Drag red pointer tool



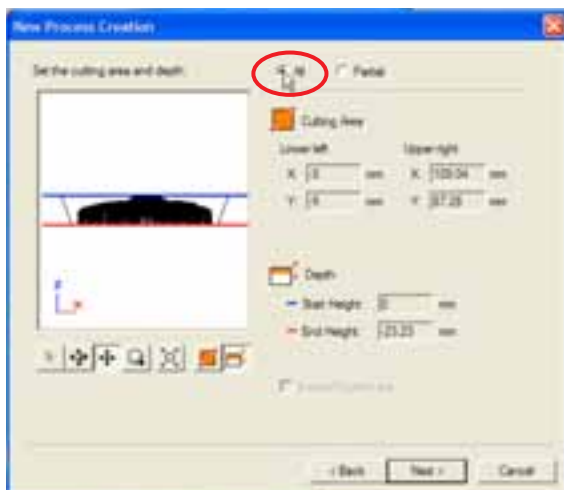
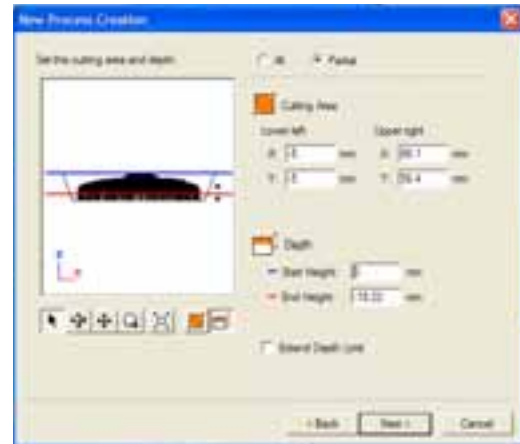
Choose the *Change Depth tool* (highlighted in red circle).

 Change Depth tool

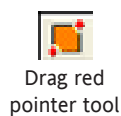


The *Preview* screen window changes to a side view of the model.

Drag the red line in the *Preview* window down all the way until it is at the bottom. We want to define the cutting to the end.



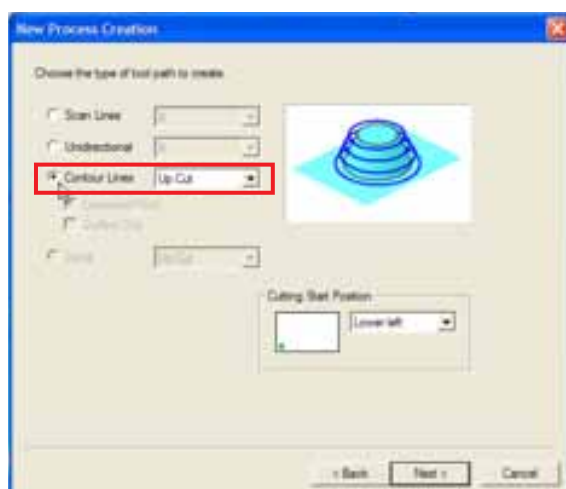
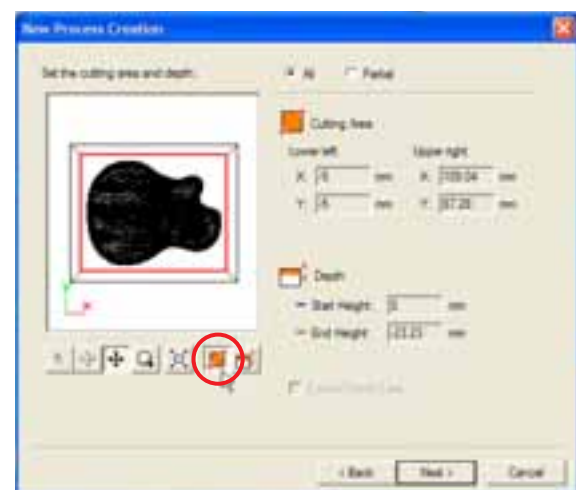
Next, select back the **All** option.



Drag red pointer tool

Select the *Drag red pointer tool* again (highlighted in red circle).

Click **NEXT** to continue.



STEP 19 Set type of tool path

In the *Path Type* dialog box, set **Contour Lines** for the type of tool path we are creating. Drop the list to choose **Up Cut**.*

With this cutting method, the direction of tool rotation is identical to the direction of tool movement.

Ensure the *Cutting Start Position* is set at **Lowerleft**. This sets the point at which the tool first approaches the workpiece.

Click **NEXT** to continue.

*see **Appendix A** for more explanations

STEP 20 Set cutting parameters

At the *Cutting Parameters* page, the default configuration is displayed out in a list. The default setting depends on the diameter of the tool you have selected previously.

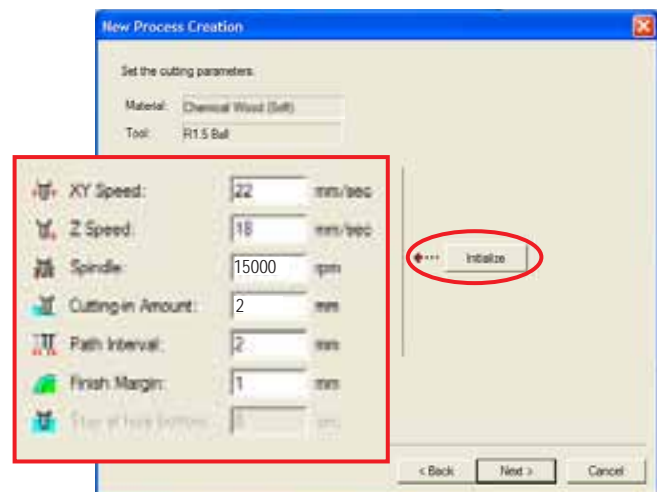
You can change these parameters if you know how to tweak them to cut faster or slower depending on the results desired.



Enter the values as shown on the right. If you have changed your mind about certain values, you can click on the **Initialize** button to reset to the default values previously.

Initialize - resets the all cutting parameters to their initial values.

Click **NEXT** to continue.



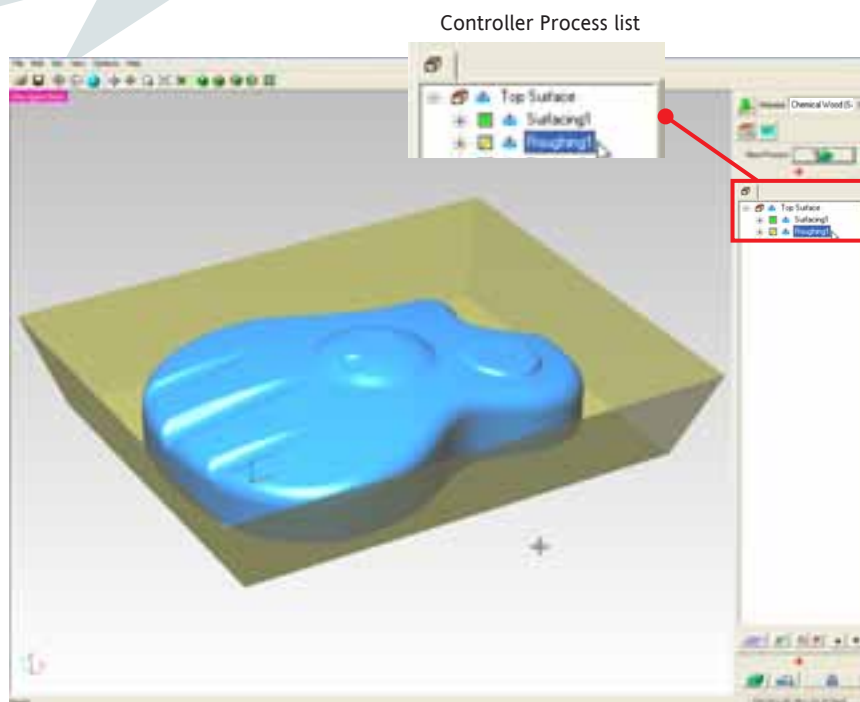
STEP 21 Save Roughing process

In the *Create Tool Path* page, enter a name to save your tool path. The name appears in the Controller process list.

Name your **Process Name** as **Roughing1** and choose **Later** option.

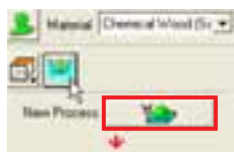
Click **Finish** to close when you are done.

Back at the Modela Player 4, you should have a **Roughing1** setting in the *Controller process list* on the right of the interface.



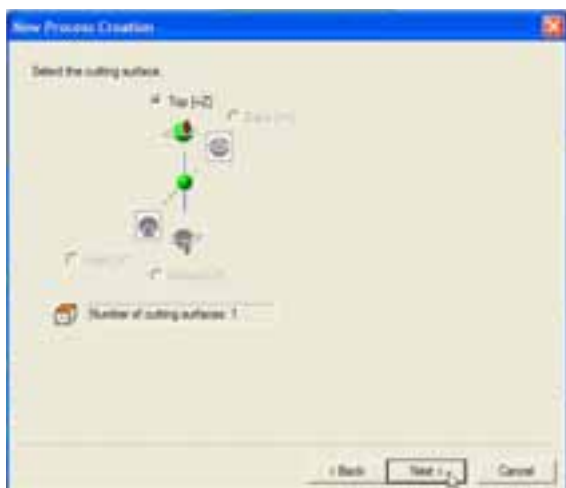
STEP 22 Define Finishing on model

By now, you should be familiar with the setting the process of cutting, as they are all the same. This time, we are defining a finishing cut to the 3D model.



Clicking on the **New Process** icon again to open up the *New Process Creation* dialog box. Let's choose **Finishing** this time, as we are done with Surfacing and Roughing previously.

Click **NEXT** to continue.



STEP 23 Choose cutting surface

At the *Cutting Surface* page, just accept the default for selecting the cutting surface: Top.

Click **Next** to continue.



STEP 24 Choose tool diameter

Choose **R1.5 ball mill** tool from the drop-down list for the cutting.

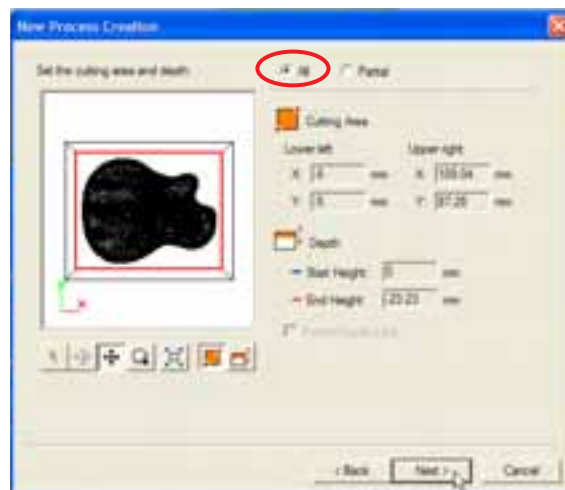
Click **Next** to continue.

STEP 25

Set area & depth for Finishing

At the *Cutting Area* dialog box, select **All** option.

Click **Next** to continue.



STEP 26 Set type of tool path

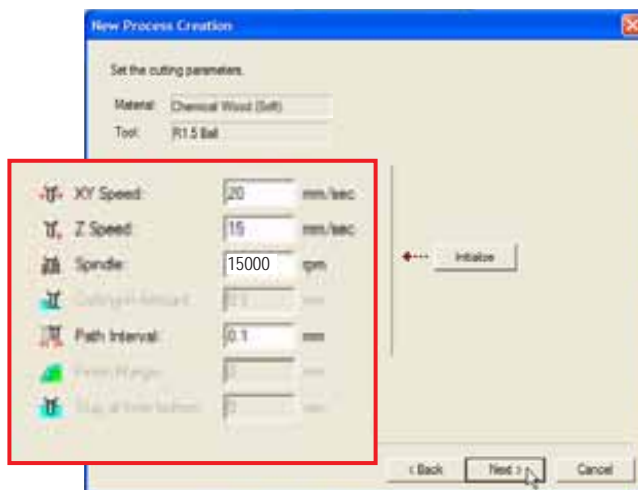
Next, choose **X** for **Scan Lines** for the type of tool path to create.

Click **Next** to continue.



STEP 27 Set cutting parameters

As before, the *Cutting Parameters* page lets you define and customize the speed at which you can control your tooling.
Shown here is the default setting for 1.5 radius ball mill.
Click **Next** to continue.



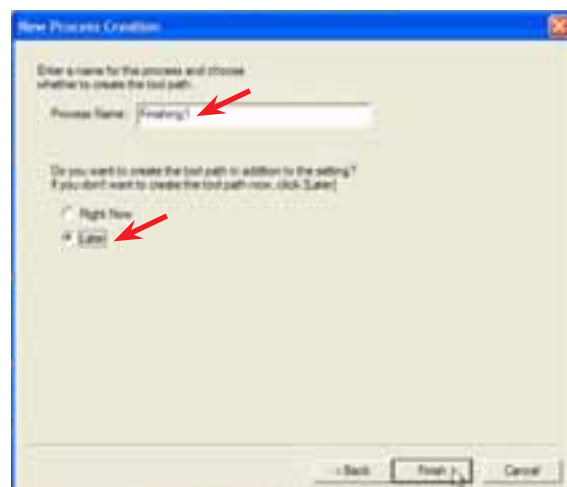
Input all values according to what is shown on the left.

Click **Next** to continue.

STEP 28 Save Finishing process

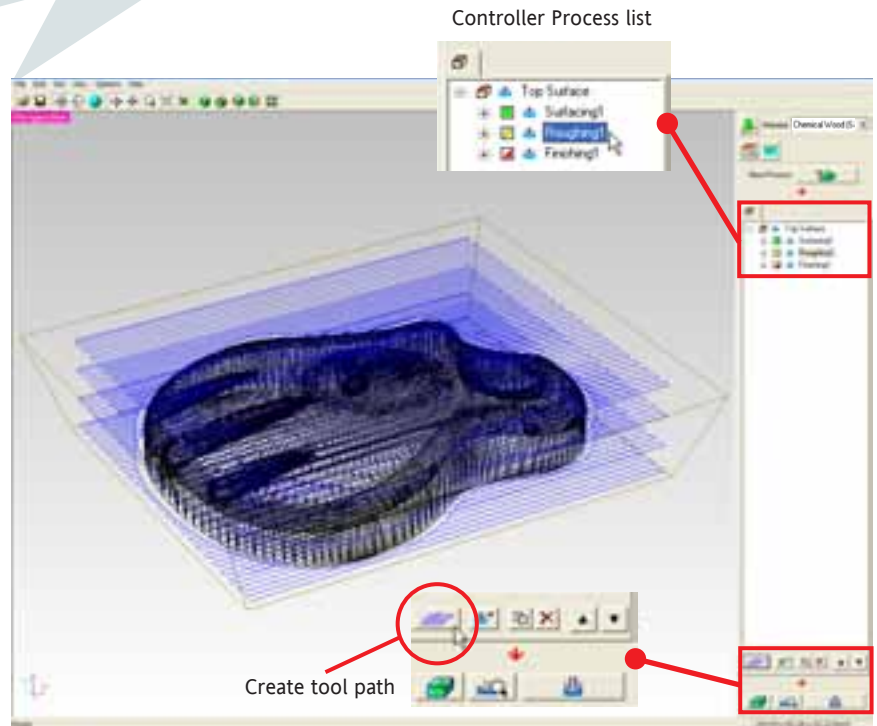
Save the configuration as **Finishing1** and select to create tool path to **Later**.

Click **Finish** to close the process.

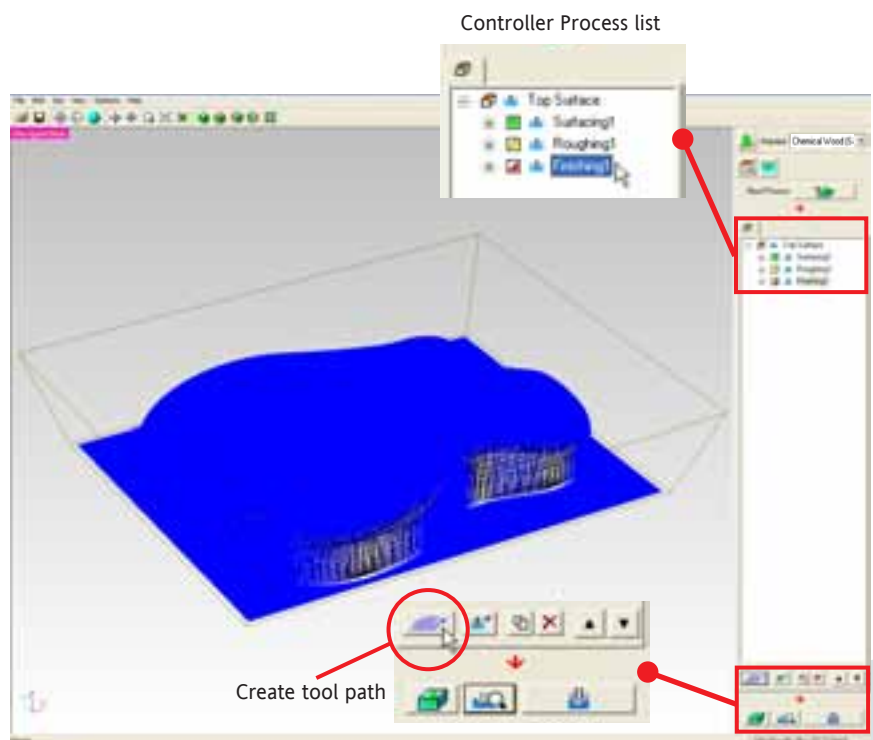


STEP 29**Create tool path for Roughing**

Back at the *Controller Process list*, select **Roughing1**. Then click on *Create tool path* icon below to generate a path for roughing.

**STEP 30****Create tool path for Finishing**

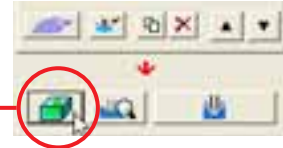
Select on **Finishing1** in the *Controller Process list*. Click on *Create tool path* icon below to generate a path for finishing.



STEP 31 Setup for cutting position

The next step will be laying out the 3D model for cutting. Click on the *Cutting Position* button at the right-hand bottom of the *Modela Player 4* interface.

Cutting Position



A *Cutting Position Setup* dialog box pops up. There are 2 tabs displayed; namely *X and Y Directions*, and *Z Direction*. These allow the user to define and position the cut accurately.

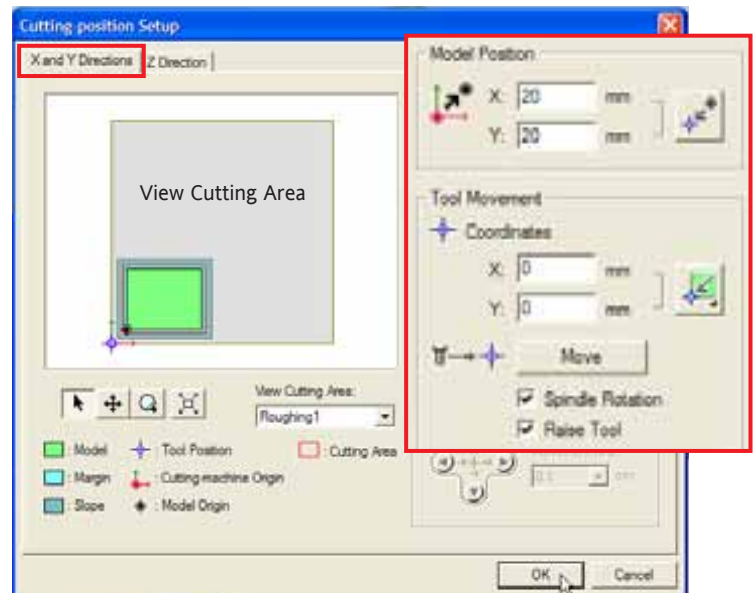
Model Position - specifies the cutting position of the model in the X and Y directions.*

Tool Movement - moves the tool to the X and Y coordinates you specify.*

Enter values for **Model Position** and **Tool Movement** columns if yours is different from the one shown on the right.

Click **OK** to close.

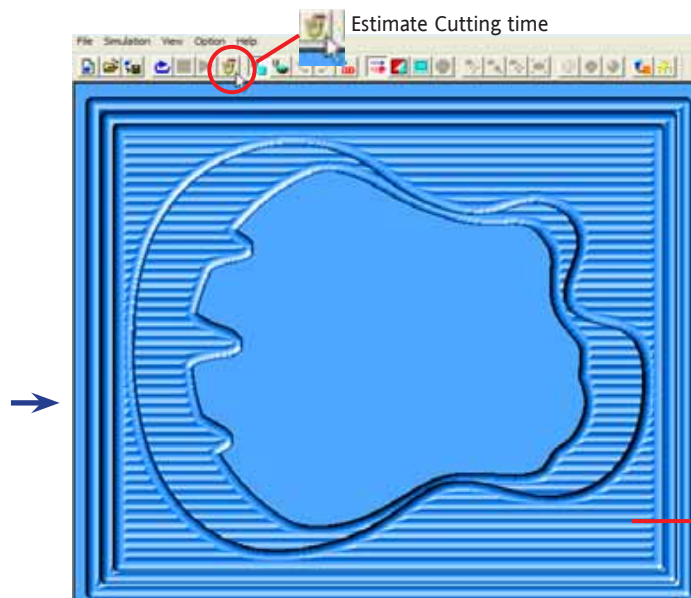
*see **Appendix A** for more explanations



STEP 32 Preview cutting in Virtual MODELA



Preview Cutting



Estimate Cutting time

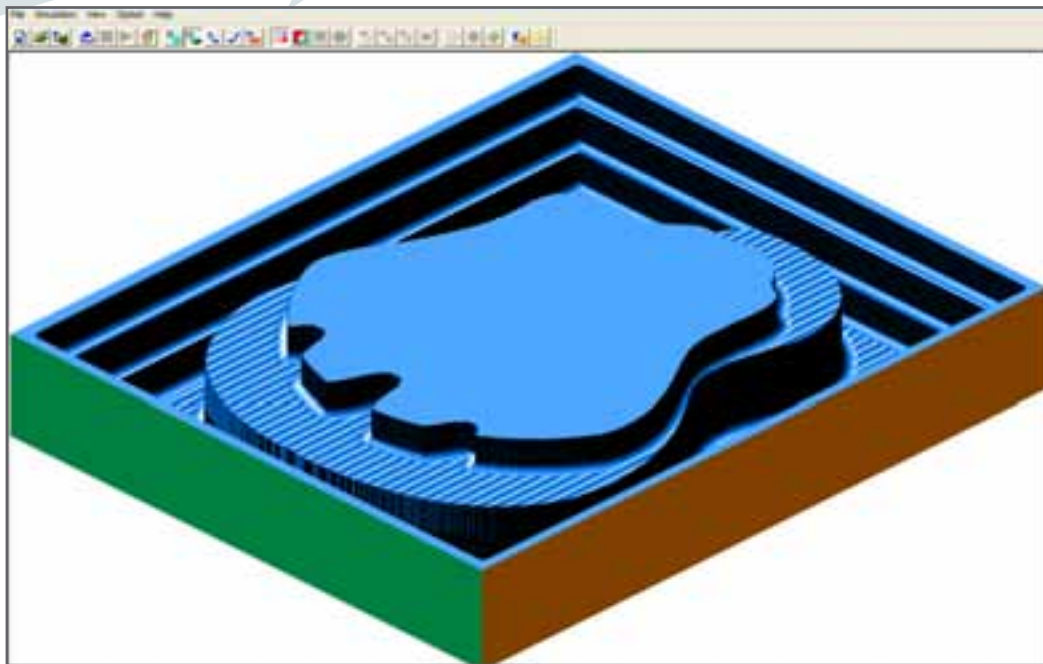


2D Simulation

Select **Roughing1** in the list and click on *Preview Cutting* button at the right bottom. This will bring up **Virtual MODELA**, a 3D preview utility from Roland. Click on button labeled as *Estimate Cutting time*. After it has calculated the time for roughing, a box displays the *Cutting Data Information*. From here, we will know an estimate of about 17 minutes for rough cutting.



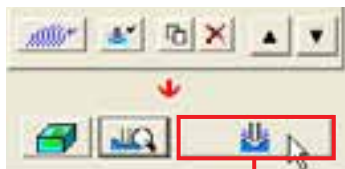
3D Simulation



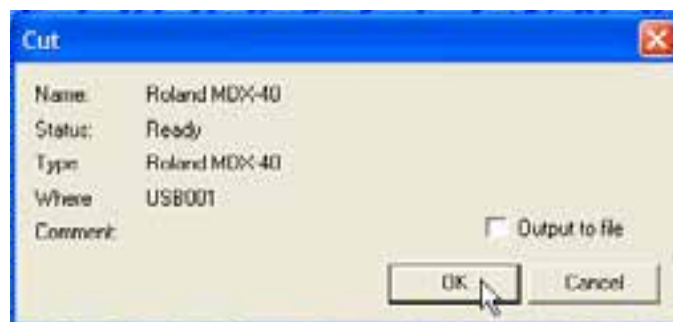
Click on *3D Simulation* button to preview as above. This will give you a good simple preview of the rough cut.

Close the program without saving the file, as this is just a guide to previewing.

STEP 33 Output cutting to MDX-40



Cut



Click on the *Cut* tool at the bottom of the interface. This will be the final command to issue, where the data from the 3D model is sent to the MDX40 machine for cutting. Click **OK** to cut.



A dialog box will keep track of the progress of cutting for **Roughing1** and **Finishing1**, through a progress bar.

Click **Continue** to proceed with cutting.



When the file has been completely sent to the queue, a message will display that the output has been done.

Click **OK**.

Photo showing **Roughing** process completed using chemical wood as an example.



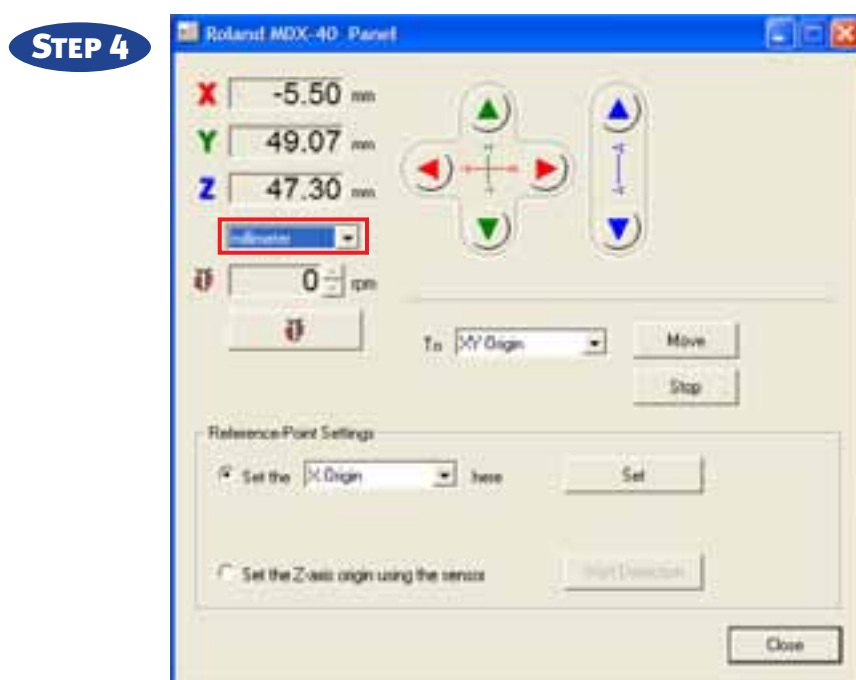
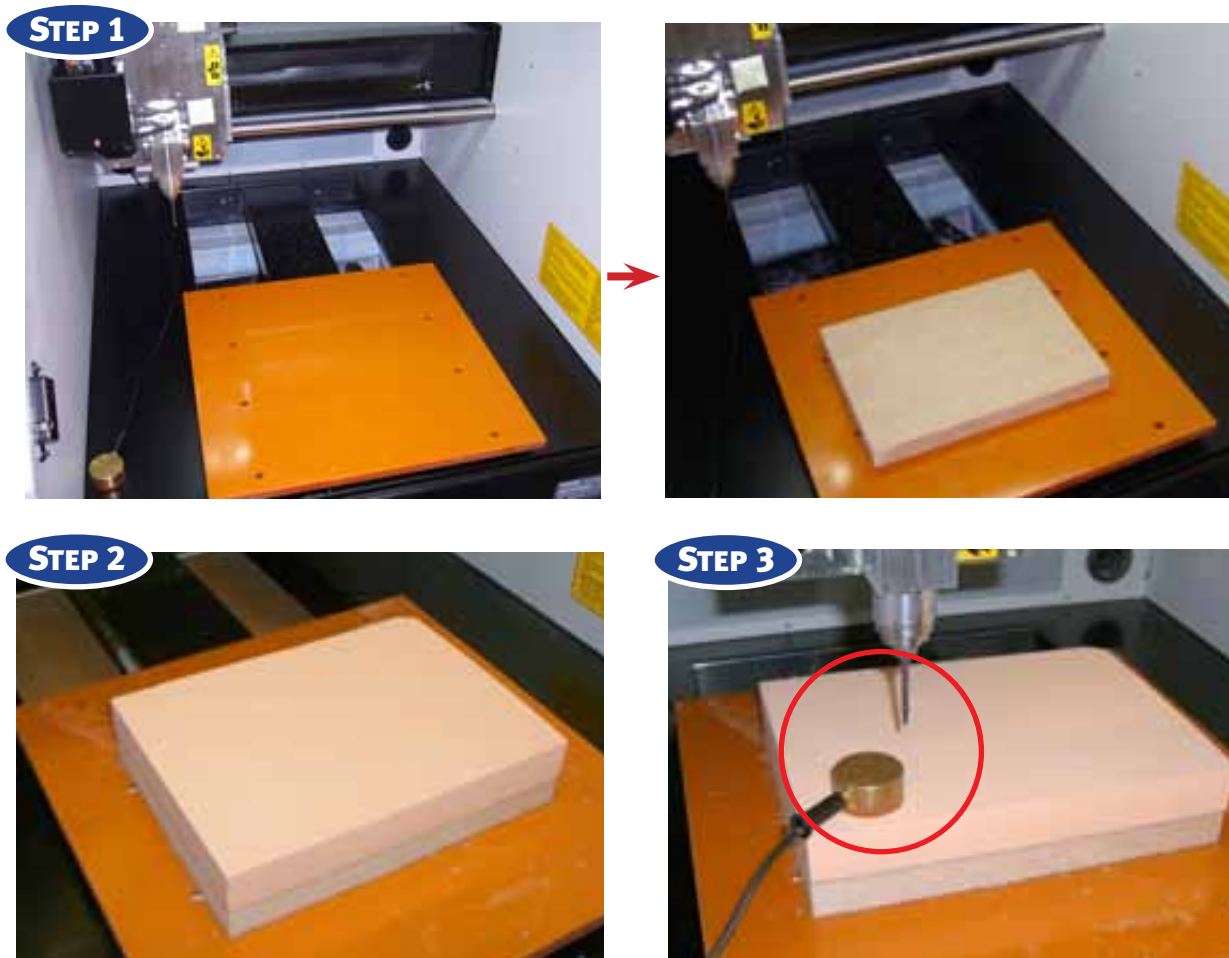
Photo showing **Finishing** process completed using chemical wood as an example.

~~~~ End of Example 1 ~~~~

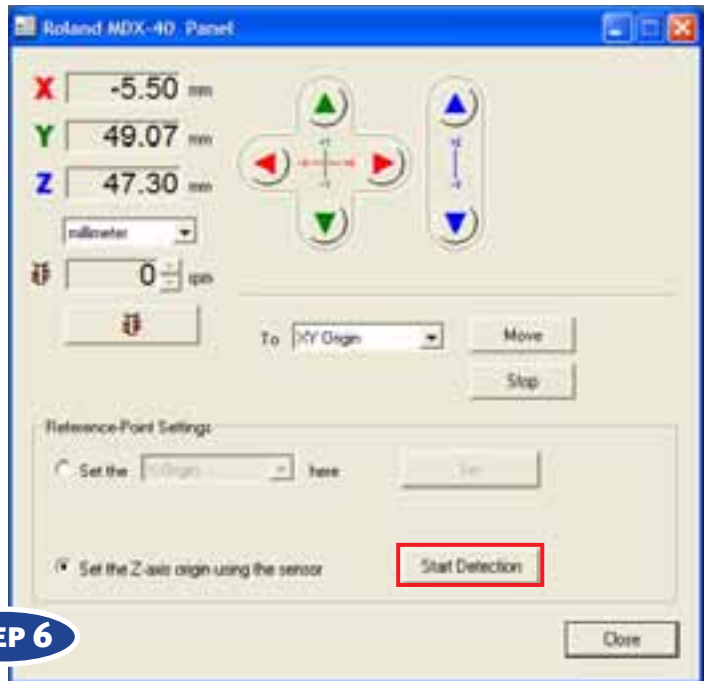
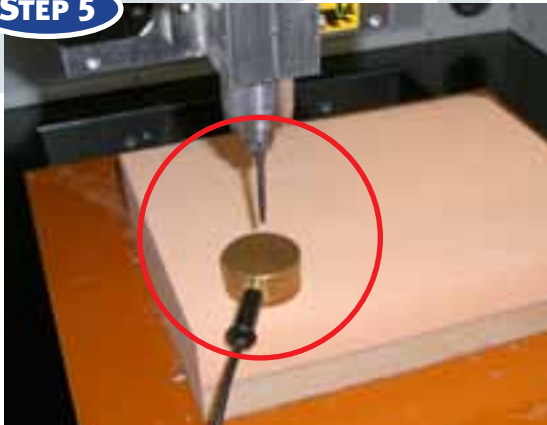


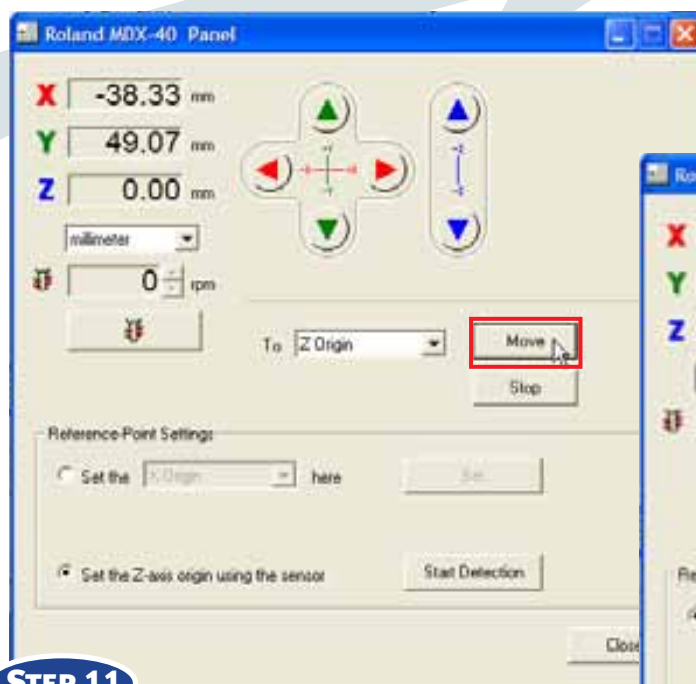
## Material Mounting & Tool Zeroing

This is a procedure that was done in the previous example. We are repeating here for you as a reminder. But no explanations will be given; only photo illustrations. If you are in doubt about these steps, please refer to the previous example on tool zeroing.

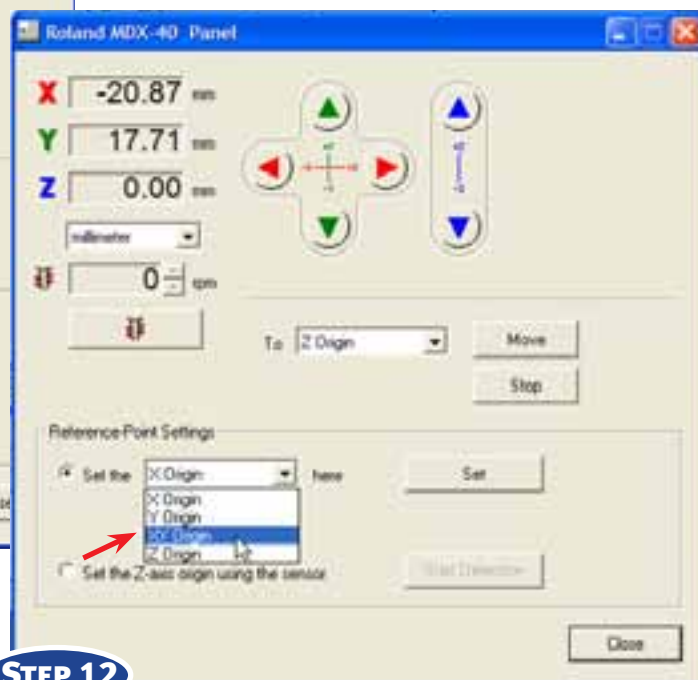




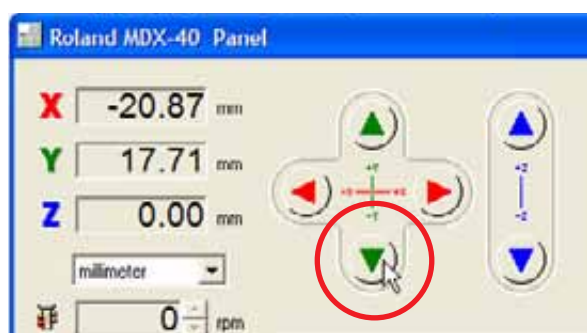
**STEP 5****STEP 6****STEP 7****STEP 8****STEP 9****STEP 10**



STEP 11



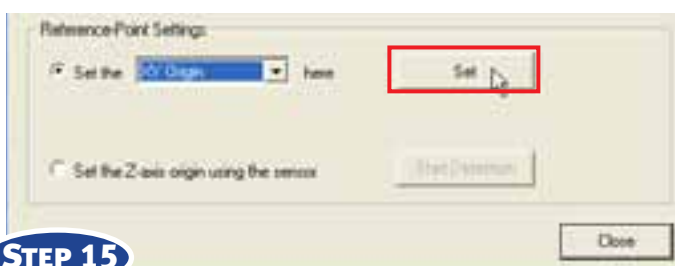
STEP 12



STEP 13



STEP 14



STEP 15

## Example 2 - Objective



To cut out a guitar body with shelling using Roland's MDX40 machine.

## List of Items to Prepare for use

1. MDX-40 machine (Power up)
2. Example file *guitar\_shell.stl*  
(downloadable from Tutorials page, Freeform Digital website)
3. 1 piece of chemical wood cut to size (L200 mm x W150 mm x H23.23 mm)
4. 1 piece of wooden block cut to size (L200 mm x W150 mm x H25 mm)  
- to be used for base support only
5. R1.5 Ball mill cutting tool
6. 4 pin guides, each measuring (Length 20 mm x Diameter 3mm)

## Example 2 - Guitar with Shelling

### STEP 1 Open example file

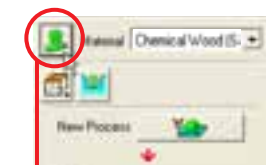
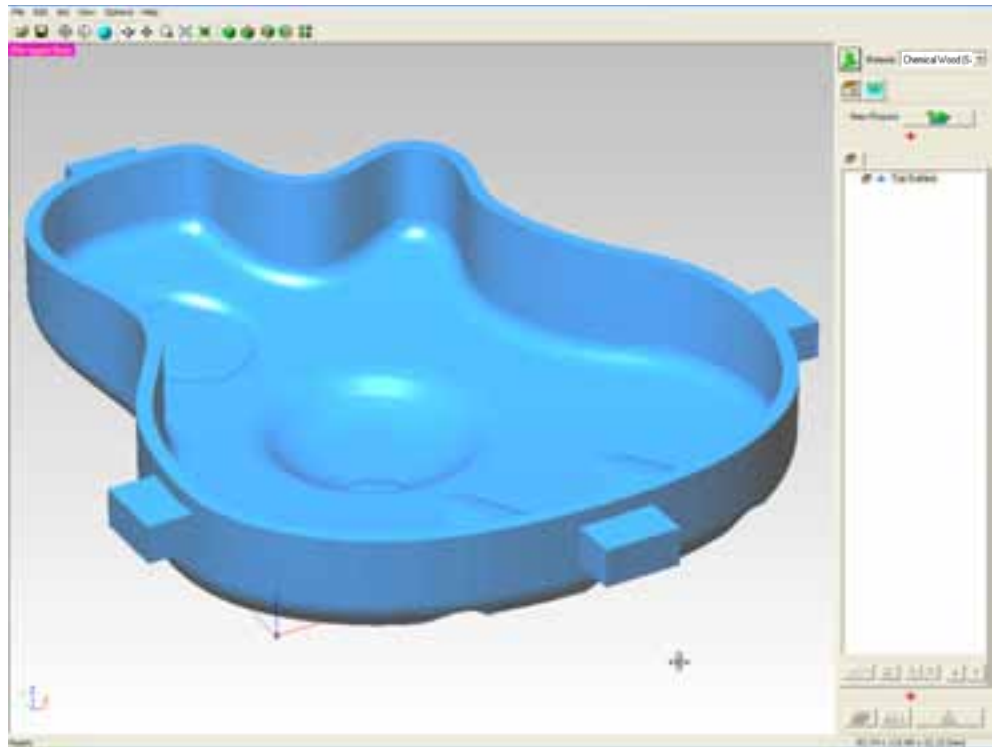
Open another example file to work on. Go to **File > Open** from the top menu.

Navigate to your folder where a file named **guitar\_shell.stl** is located.

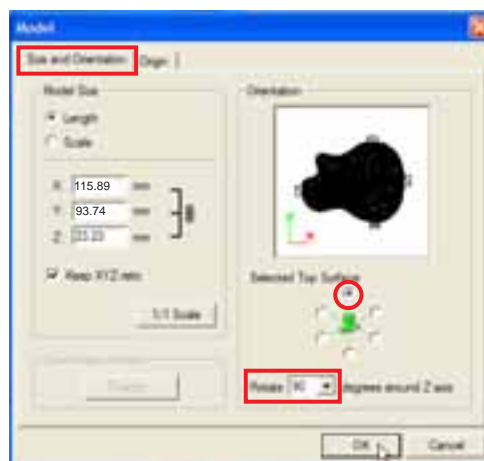
Click **Open** the file. You should have the view as shown on the right.

#### Note:

Starting from this example, certain detailed explanations will NOT be repeated as they have been either explained before or in the **Appendix** section at the back of the annual. If in doubt, please kindly refer to the previous example for clarification.



Model

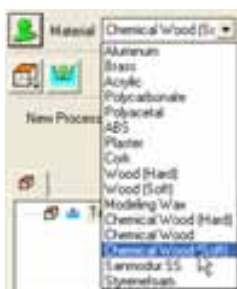


### STEP 2

#### Layout 3D model

Click on **Model** icon to bring up the dialog box. Under the *Size and Orientation* tag, select the top surface and **90** degrees in the *Orientation* column. These are shown with the highlighted reds.

Click **OK** to close. Notice the preview of the 3D model updates at once.



Top & bottom surfaces

### STEP 3 Choose material and surface

Select your cutting material to **Chemical Wood (Soft)**.

Choose top and bottom surfaces to be cut from the **Number of Cutting Surfaces** icon shown on the left.



Modeling Form

**STEP 4****Forming model for cut**

Next, click on **Modeling Form** icon.  
Click on **Margin** tag. Ensure **Manual** is selected. Enter **0 mm** for all measurements.

Continue next to **Depth** tag.

Ensure **Top/Bottom** option is selected.

Make sure that the *blue* and *red* lines are displayed according to what is shown on the right.

If not, use the navigational tools below the *Preview* to position to what is shown.



In the **Slope** tag, leave all options unchanged and proceed next.

At **Cutting Area** tag, just ensure everything is unchanged as shown on the right.

Now, click **OK** to close.

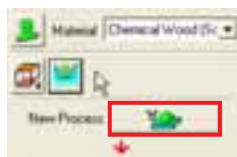




## STEP 5 Define Roughing on model

Create a **Roughing** process through the **New Process** icon highlighted in red.

Click **Next** to continue.



## STEP 6 Choose cutting surface

For cutting surface, select the **Top** surface by clicking on the radio button. Click **Next**.



## STEP 7 Choose tool diameter

As usual, choose **R1.5 ball mill** for the cutting tool. Click **Next**.

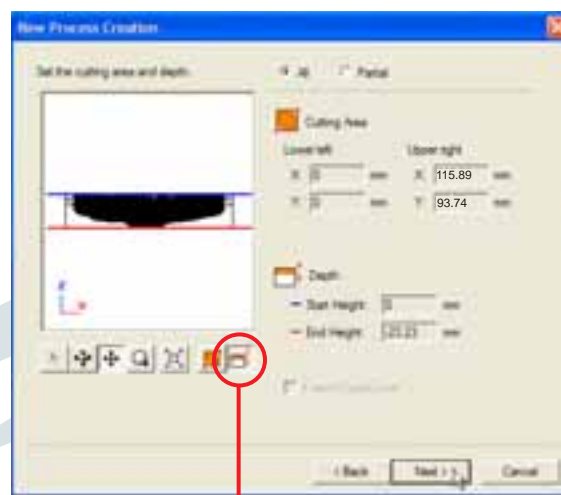


## STEP 8

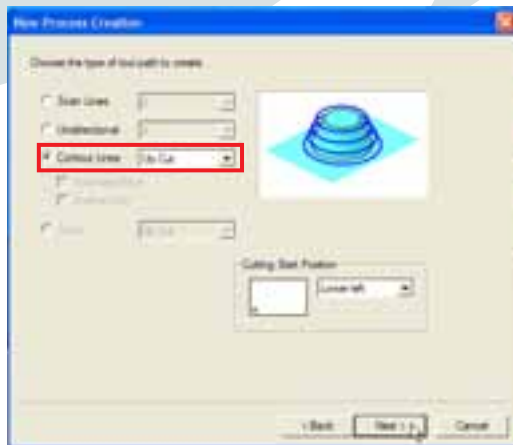
### Set area & depth for Roughing

To set cutting depth, ensure **All** option is selected. Click on the **Change Depth** tool to switch the **Preview** to the side view.

Click **NEXT**.



Change Depth tool



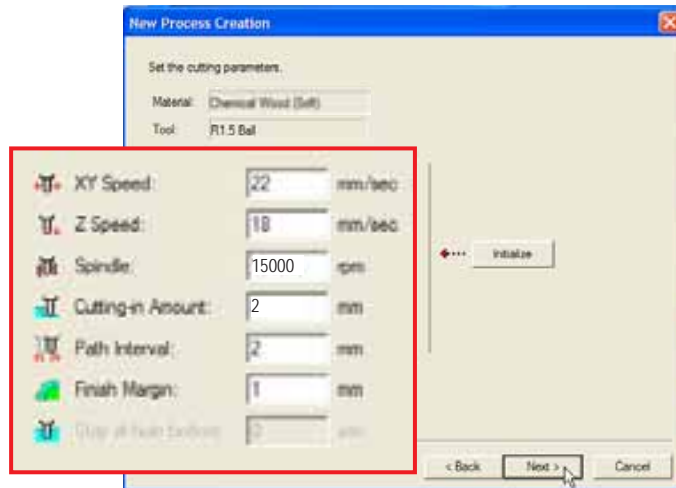
### STEP 9 Set type of tool path

Select **Contour Lines** for the type of tool path to create. Ensure **Up cut** is chosen at the drop-down list.

Click **Next**.

### STEP 10 Set cutting parameters

Coming to the cutting parameters, we need to change some values other than the given defaults.



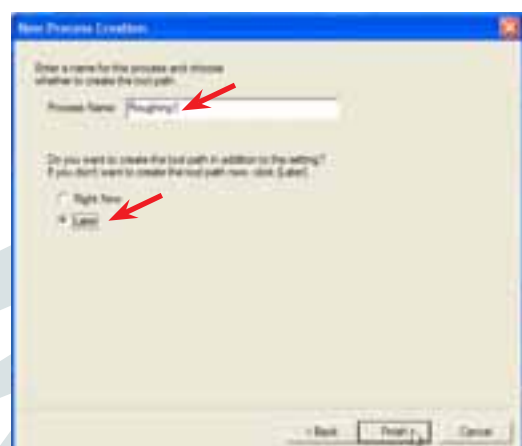
Change the values to what is shown.

Click **Next**.

### STEP 11 Save Roughing process

Save Roughing process as **Roughing1**, and create the tool path later.

Click **Finish** to close.



## STEP 12 Define Finishing on model

Start another process - **Finishing** this time. By now, you should realise that the process creation for cutting 3D models is the same as before.

Click **New Process** icon on the right. In the dialog box that appears, select **Finishing** and click **NEXT**.



## STEP 13 Choose cutting surface

For cutting surface, select **Top** surface to be cut.

Click **NEXT**.

## STEP 14 Choose tool diameter

Select **R1.5 Ball mill** for the cutting tool.

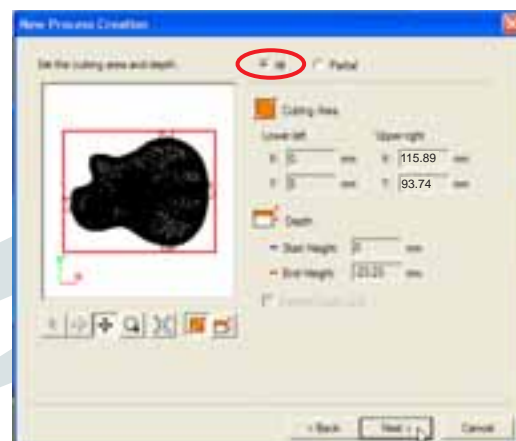
Click **NEXT**.

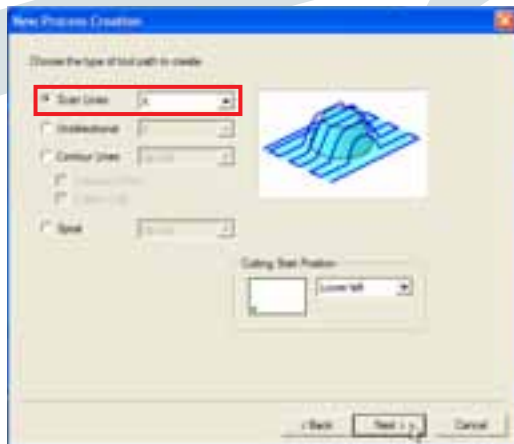


## STEP 15 Set area and depth for Finishing

Ensure **All** option is selected for cutting area and depth page. Also, check that the layout of the model is correctly laid out as shown on the right.

Click **NEXT**.





### STEP 16 Set type of tool path

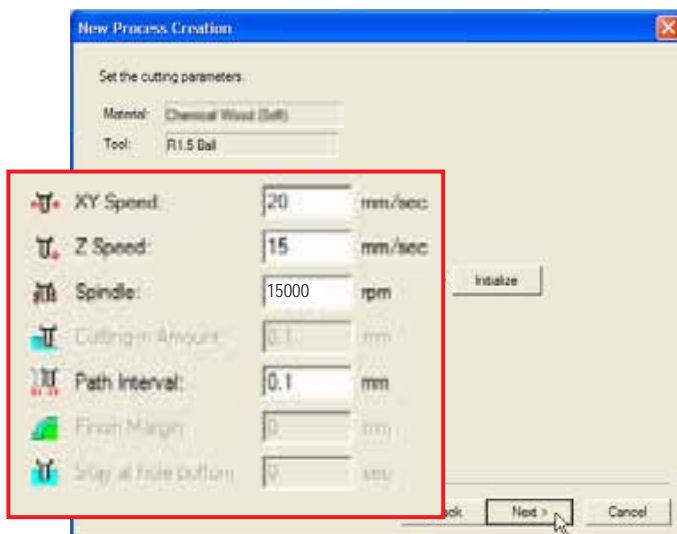
For creating type of tool path, choose **Scan Lines**. From the drop-down, select **X**.

Click **NEXT**.

### STEP 17 Set cutting parameters

At the cutting parameters page, we see that this is the default settings.

Let's tweak by changing some of the values.



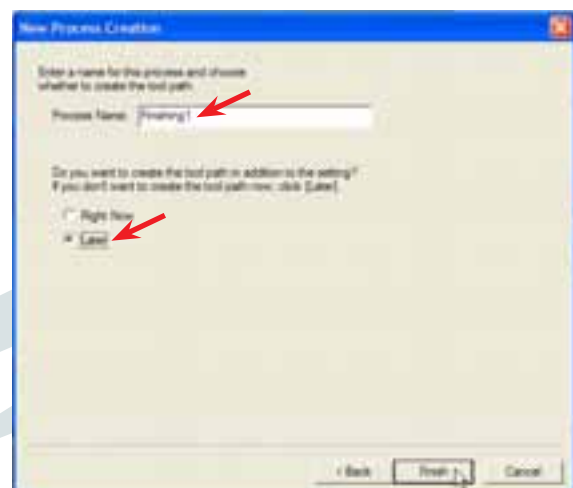
Change the values as shown on the left.

Click **NEXT**.

### STEP 18 Save Finishing process

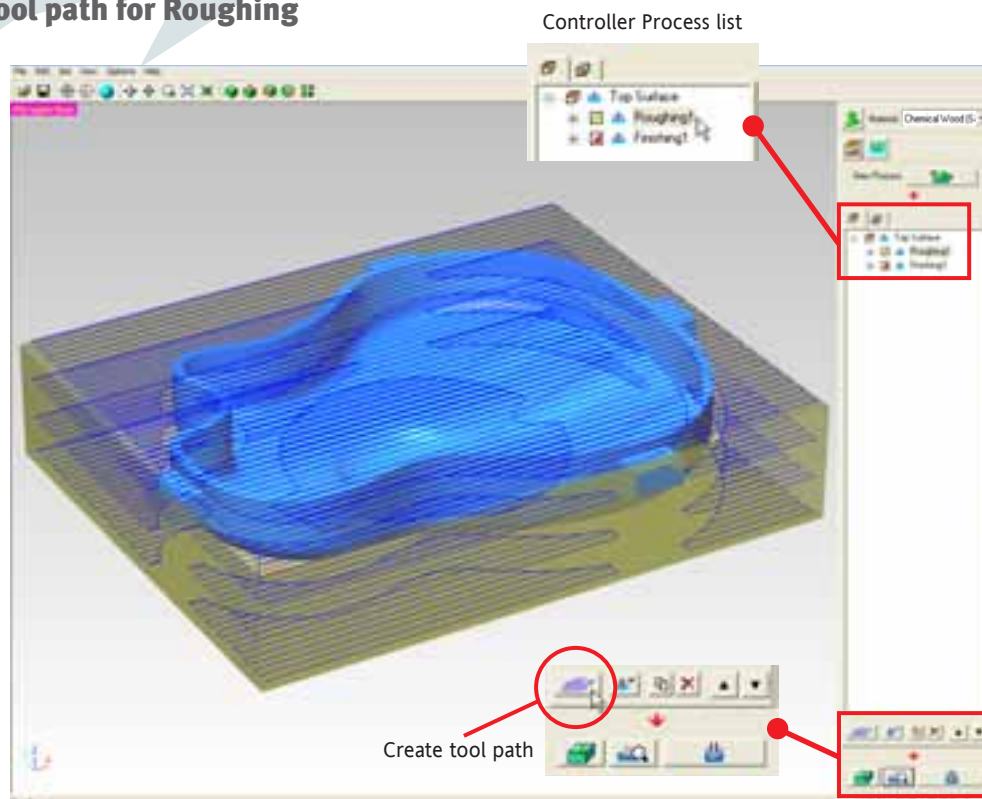
Save the process as **Finishing<sub>1</sub>** and create tool path later.

Click **Finish** to close.



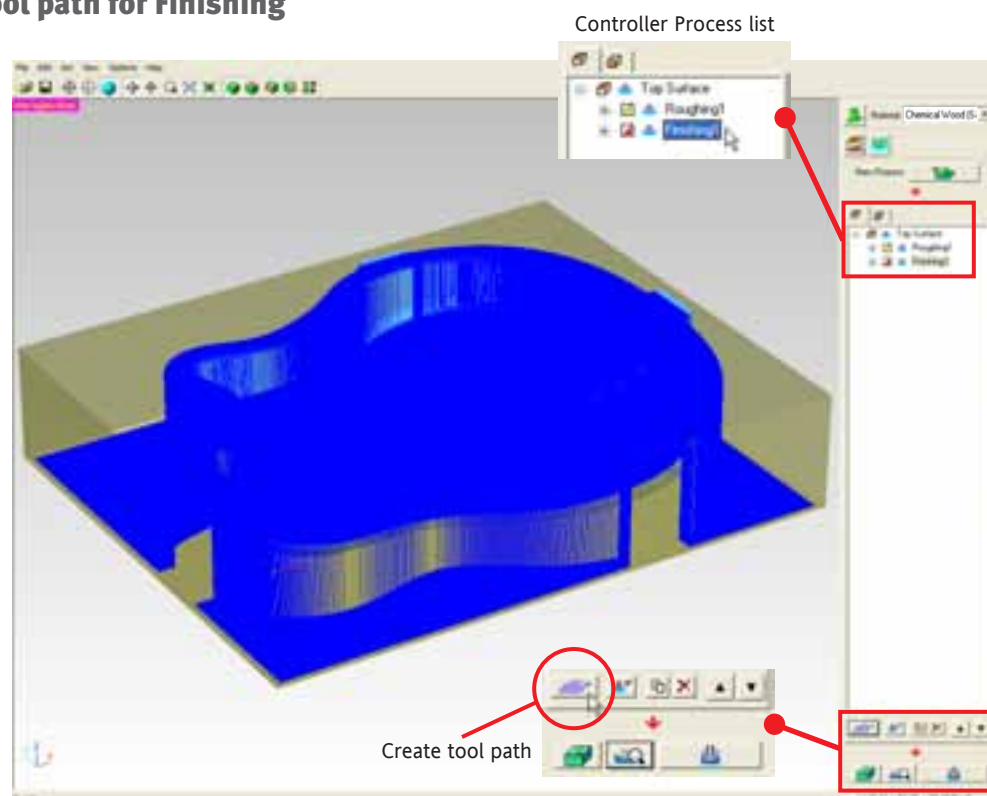
## STEP 19 Create tool path for Roughing

Back at the *Controller Process list*, select **Roughing1**. Then click on *Create tool path* icon below to generate a path for roughing.



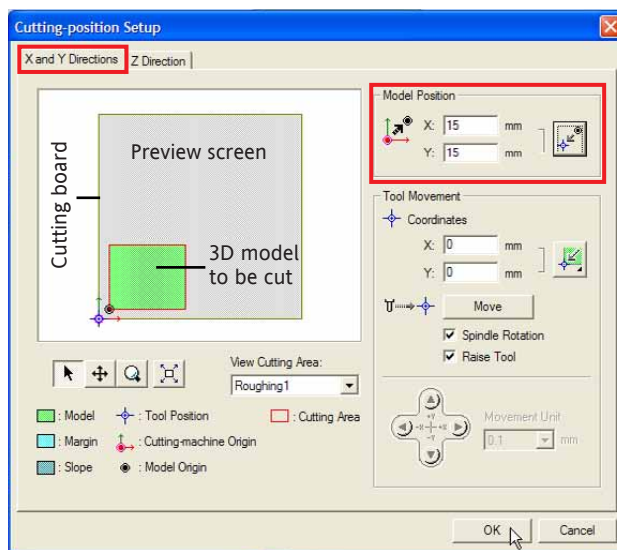
## STEP 20 Create tool path for Finishing

Select on **Finishing1** in the *Controller Process list*. Click on *Create tool path* icon below to generate a path for finishing.



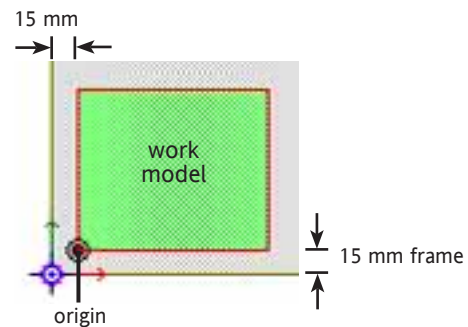
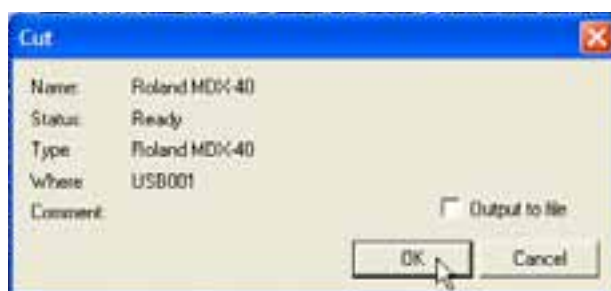


Cutting Position

**STEP 21 Setup Cutting Position**

Next, click on the **Cutting Position** icon.

When the *Cutting position Setup* dialog box came up, enter **15 mm** respectively for **X** and **Y** under *Model Position*. We are creating a frame of **15 mm** from the origin point of the cutting board. Click **OK** to close.

**STEP 22 Setup Cutting Position**

Preview your 3D model before cutting by clicking on **Preview Cutting** button. This triggers the **Virtual Modela** utility program. Check on the time taken to cut for roughing and finishing respectively.

Click on the **Cut** tool at the bottom of the interface. This will be the final command to issue, where the data from the 3D model is sent to the MDX40 machine for cutting.

Click **OK** to cut.

**STEP 23****Send output to machine**

A dialog box will keep track of the progress of cutting for **Roughing1**, through a progress bar.

Click **Continue** to proceed with cutting.



When the file has been completely sent to the queue, a message will display that the output has been done.

Click **OK**.

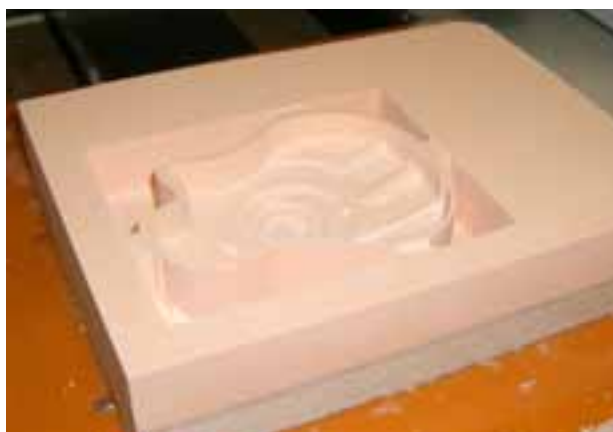


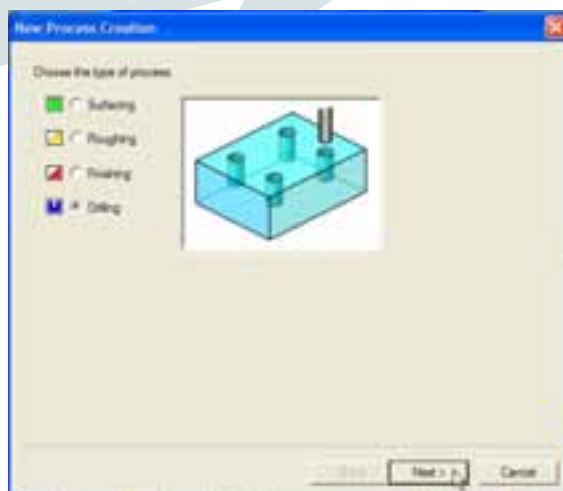
Photo showing **Roughing** process completed using chemical wood as an example.

Photo showing **Finishing** process completed using chemical wood as an example.





New Process

**STEP 24****Define Drilling on model**

Create a new process called **Drilling** by clicking on the New process icon on the right of the interface. Click **Next**. Then in the next interface, select **Top** for the cutting surface.

Click **Next**.

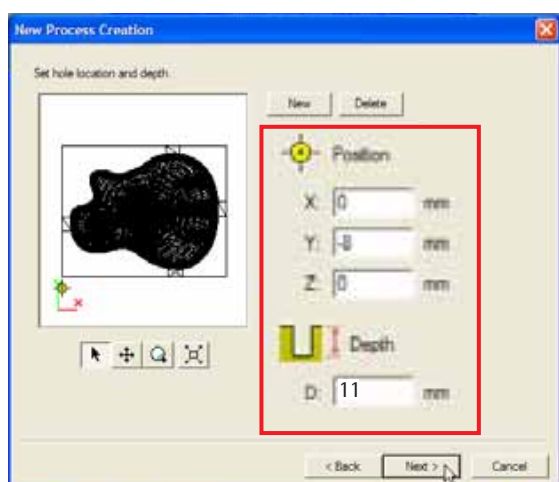
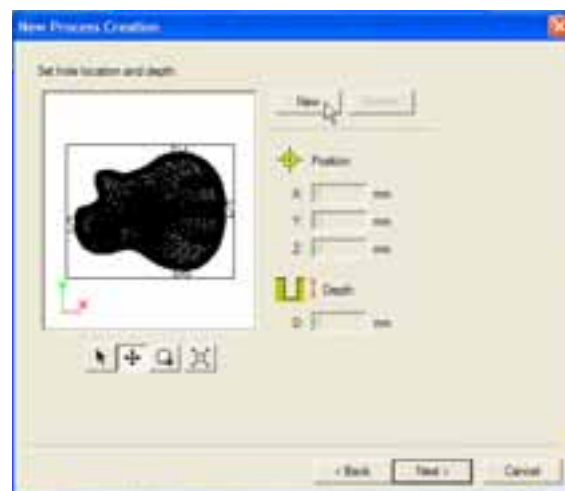
**STEP 25 Choose tool diameter**

Select **3mm Drill** from the tool drop-down list.

Click **Next**.

**STEP 26 Set hole location & Depth**

At setting the *Hole location and Depth* dialog box, click on **New** button.



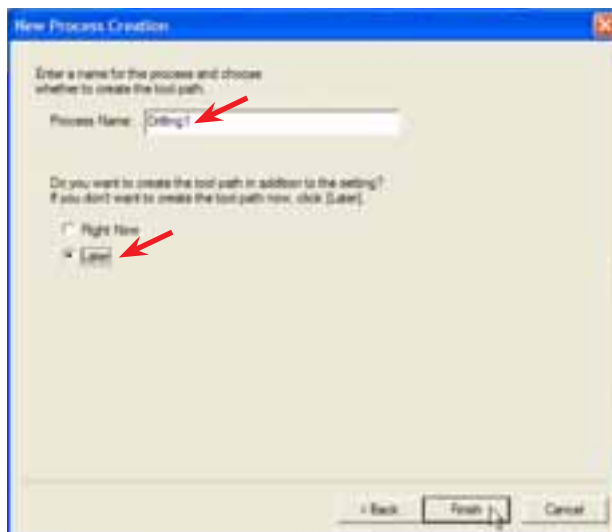
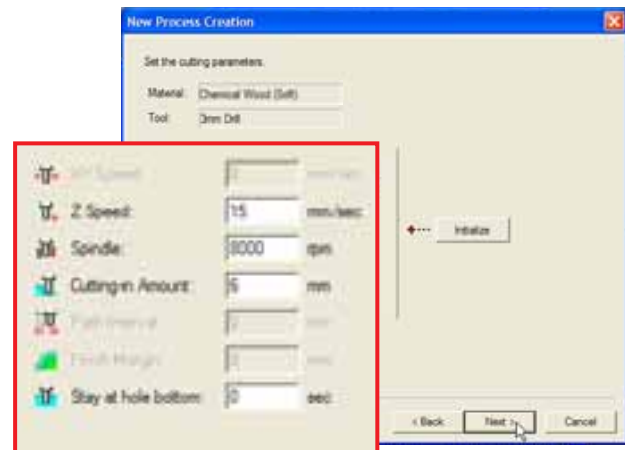
Set **Y position = -8 mm** and **Depth = 11 mm**.

Click **Next**.

**STEP 27 Set cutting parameters**

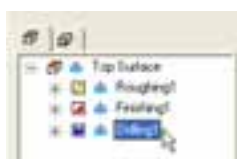
Enter the values as shown on the right, overwriting the defaults.

Click **NEXT**.

**STEP 28 Save Drilling process**

Save the process as **Drilling1** and create tool path later.

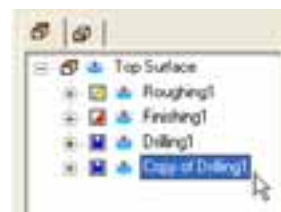
Click **Finish** to close.

**STEP 29 Duplicate Drilling hole 1**

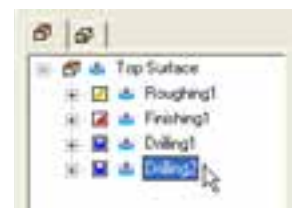
**1** Select process



**2** Duplicate process



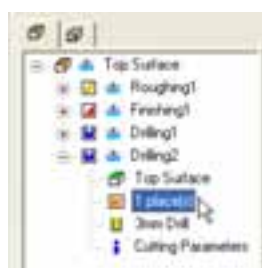
**3** Select Duplicate



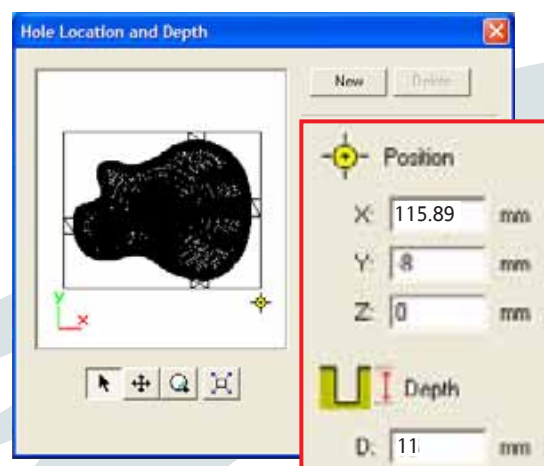
**4** Rename



**5** Click on + sign



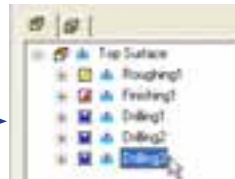
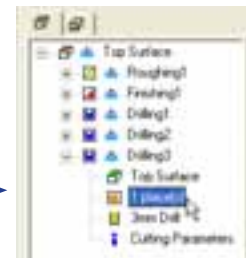
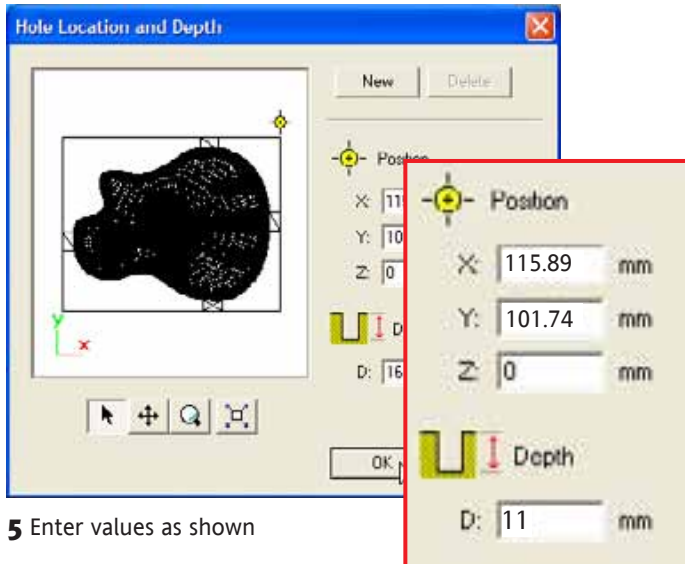
**6** Double-click 1 place(s)



**7** Enter values as shown

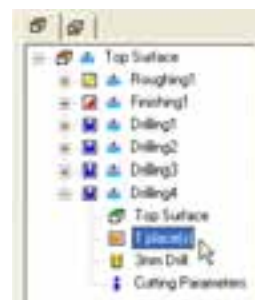
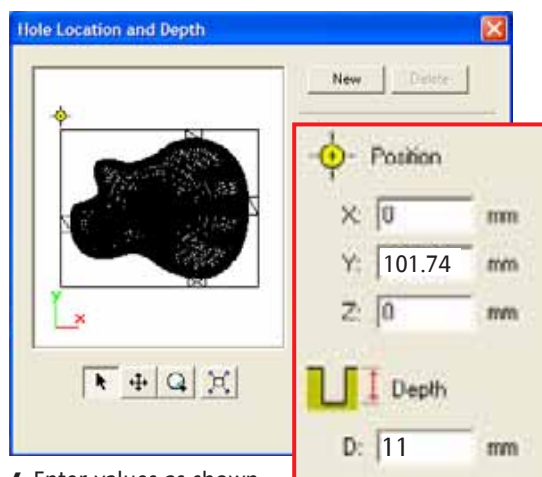
Follow the steps outlined above. We need to duplicate the hole drilling process quickly in this manner.

After having completed all steps, click **OK** to close.

**STEP 30 Duplicate Drilling holes 2 & 3****1** Select process**2** Duplicate process**3** Select Duplicate**4** Rename Duplicate and Click on + sign. Double-click 1 place(s)**5** Enter values as shown

Follow the steps outlined above. Repeat the previous step of duplicating drilling holes.

After having completed all steps, click **OK** to close.

**STEP 31 Duplicate Drilling hole 4****1** Select and Duplicate process**2** Select and Rename Duplicate**3** Click on + sign. Double-click 1 place(s)**4** Enter values as shown

Follow the steps outlined above. Repeat the previous step of duplicating drilling holes.

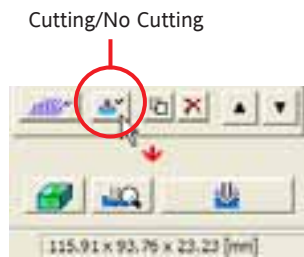
After having completed all steps, click **OK** to close.



## STEP 32 Turn off Roughing and Finishing processes



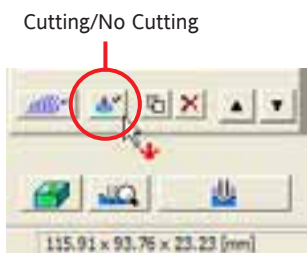
**1** Select Roughing1



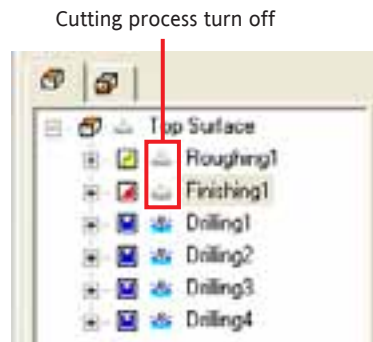
**2** Select Cutting/No Cutting icon to turn off Roughing1



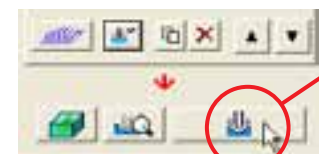
**3** Select Finishing1



**4** Select Cutting/No Cutting icon to turn off Finishing1

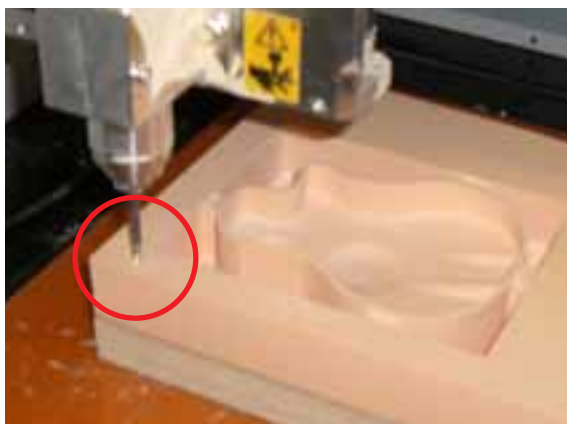


**5** Cutting for Drilling process enabled while Roughing1 and Finishing1 are disabled



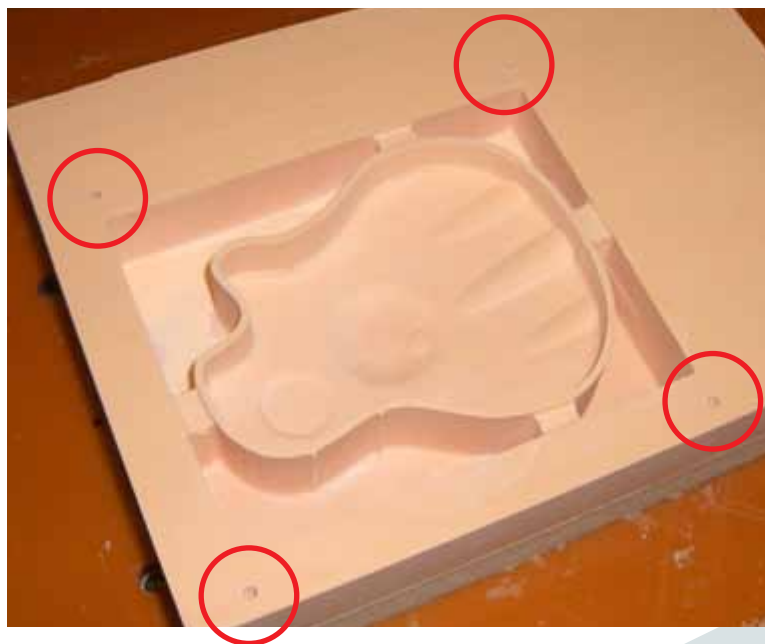
**6** Click on the Cut button to begin drilling process

Now, we are going to drill 4 holes around the 3D model. So we do not need to process Roughing and Finishing for the time being. Follow the above steps to turn off Roughing1 and Finishing1. We shall proceed to drilling process at once.

**STEP 33** Drill hole alignments

Since we have finishing with the first side of the 3D model, we shall now proceed to do a flipping over to continue cutting on the other side.

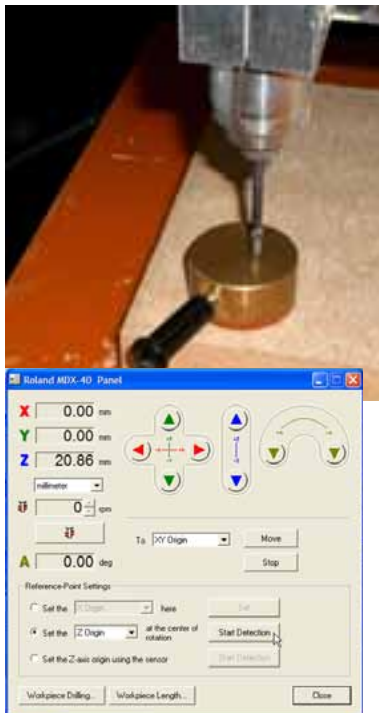
We have to drill some holes on the frame of the model to enable us to align properly the cutting of both sides.



Position the tool to drill at the sides as shown. You just need to drill up to the depth given - 11 mm.

**STEP 34** Arrow marking

Use a marker to draw an arrow as shown. This is to indicate the direction at which the model is taken out, so that we will remember its position. It will aid us in turning over the model in the correct direction later. Now, use any solvent like alcohol to remove the model from the wood base support.

**STEP 35** Set sensor and hole drilling

Position sensor on top of the wood piece. Place tool just above the sensor. For details on how we do this, refer to the previous example on tool zeroing.



Start drilling the 1st hole on the wood base support.

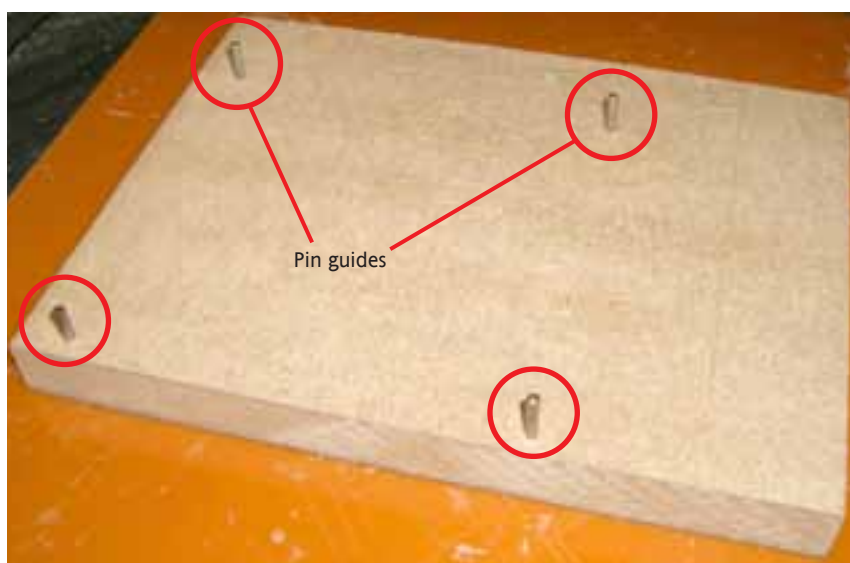


Drill the subsequent holes accordingly.

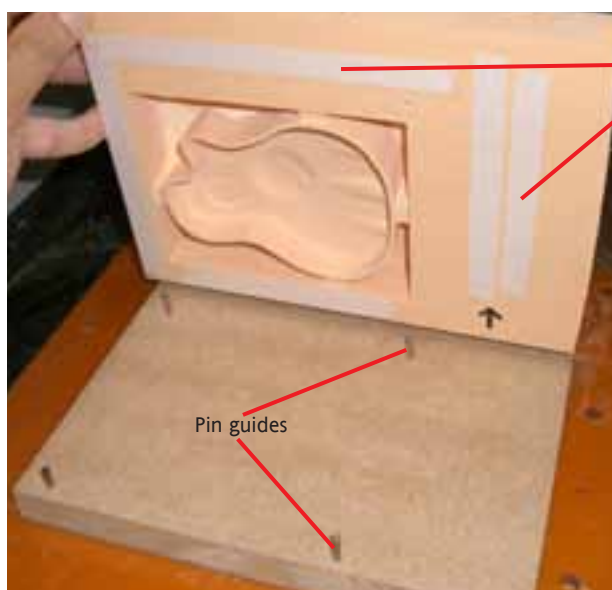


All of the 4 holes drilled as shown on the wood support. This enable us to align and lock the chemical wood firmly onto the wood support later.

Place pin guides (comes with the MDX-40 package) onto the 4 holes as shown. **Length** of pin guides is **20 mm** and **3mm** in **diameter**.

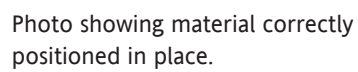
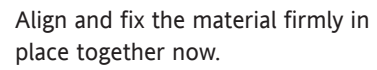


### STEP 36 Positioning & aligning material



Double-sided tape used

Place the cut surface of the model by flipping over according to what is shown. Place double-sided tape on the surface to enable better grip between surfaces.



As usual, do the tool zeroing procedure as shown.



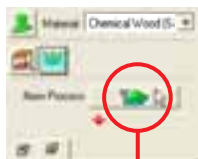
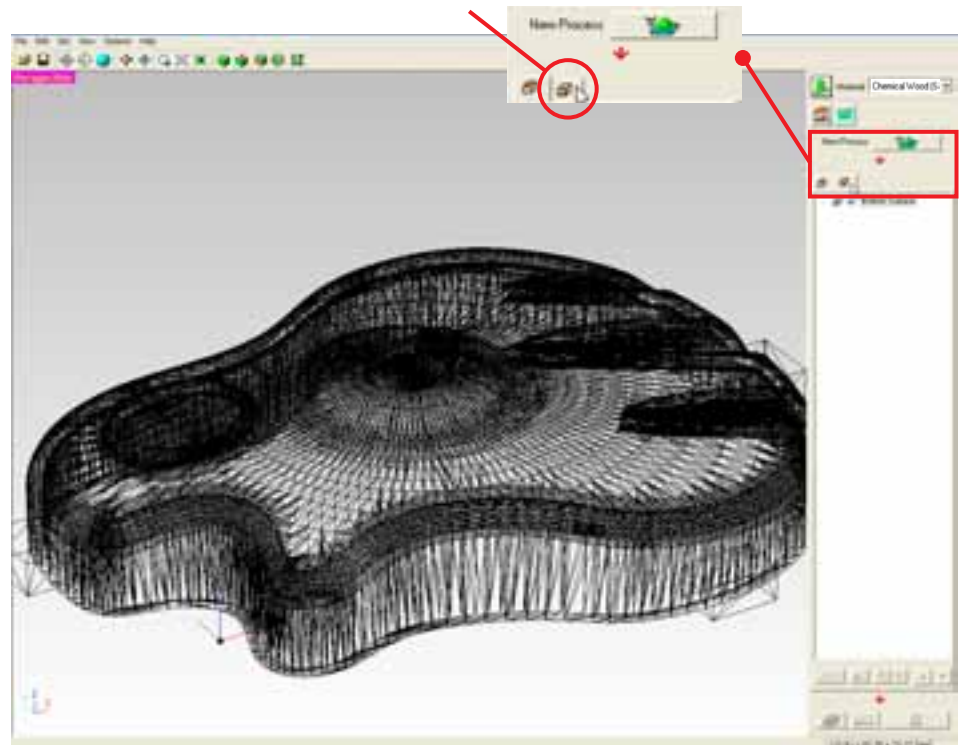
**STEP 38** Flip over model

To continue cutting the model, we need to flip over to the other side.

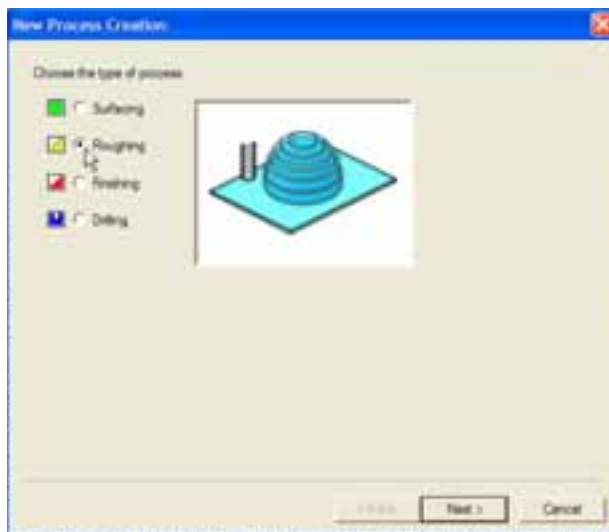
This is done by clicking on the *Bottom surface* tag as shown on the right.

When done, the screen preview will refresh and the change is seen from the right.

click on  
Bottom surface



New Process

**STEP 39****Define Roughing on model**

Click on *New Process* icon to bring up this dialog box. Choose **Roughing** and click **NEXT**.

**STEP 40****Select cutting surface**

When it comes to selecting the cutting surface, choose the **Bottom (-Z)** and click **NEXT**.



### STEP 41 Choose tool diameter

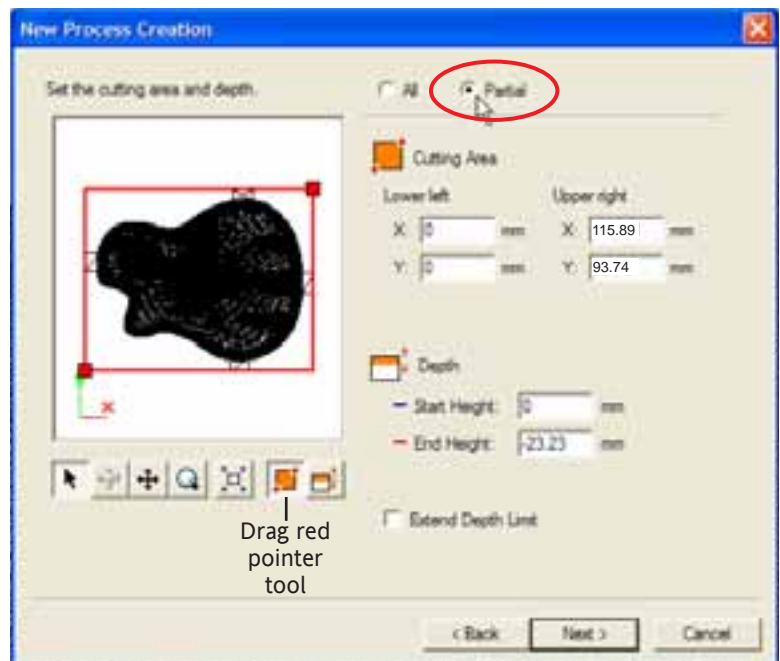
Select **R1.5 ball mill** from the tool drop-down list.

Click **NEXT**.

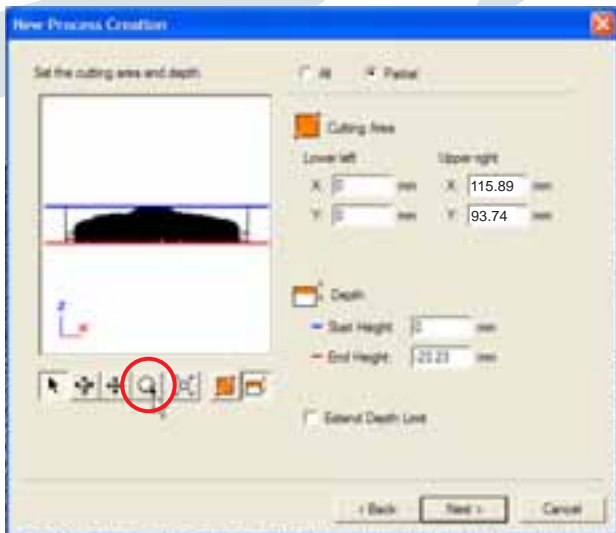
### STEP 42

#### Set cutting area & depth

Select **Partial** option to allow manual inputs of values. Change preview by ensuring that the Cutting Area is as follows: **Lower left X /Y = 0 mm** and **Upper right X = 115.91 mm** and **Y = 93.76 mm**.



Change preview by clicking on *Change Depth* icon. Enter **Start Height = 0 mm** and **End Height = -23.23 mm**. You can also drag the red line in the preview all the way to the bottom.



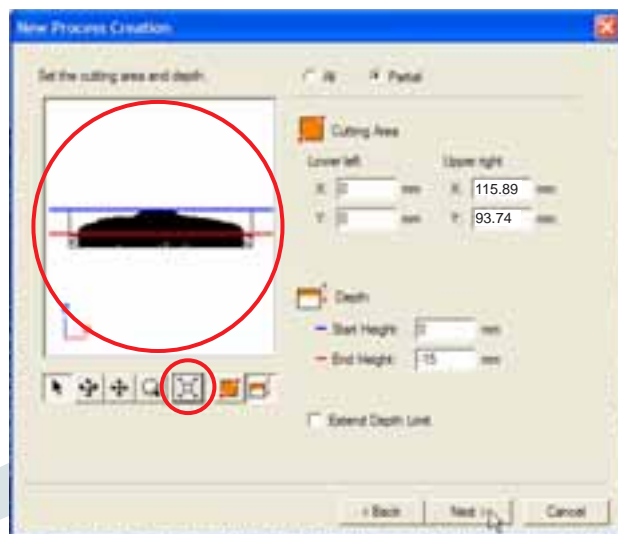
Click on the *Zoom* tool to enlarge preview of the model.

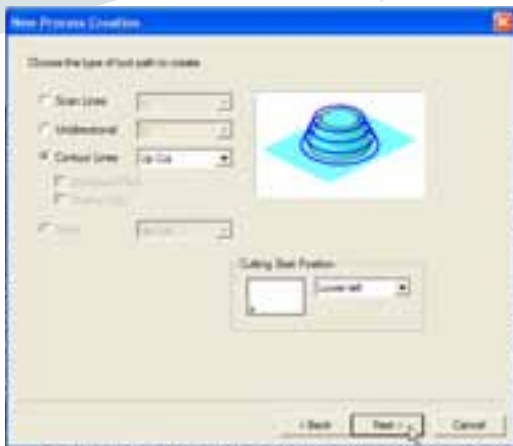


Click and drag the red line upwards to the somewhere in the middle of the model.  
To be precise, enter **End Height = -15 mm** instead.

Click on the *Fit to screen* icon to return back to full screen preview.

Click **NEXT**.





### STEP 43 Set type of tool path

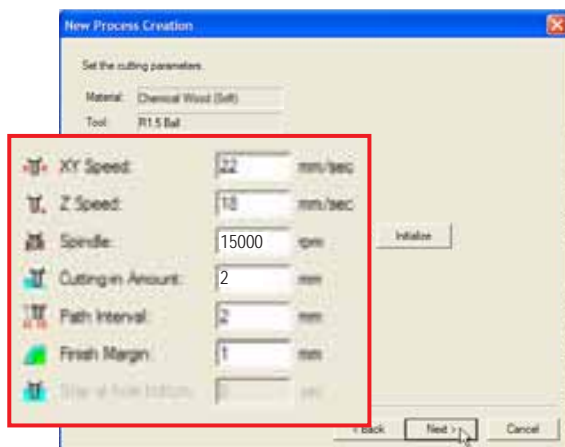
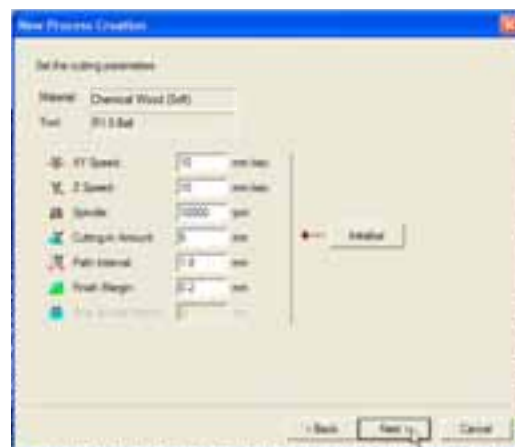
For creating type of tool path, choose **Contour Lines**. From the drop-down, select **Up Cut**.

Click **NEXT**.

### STEP 44 Set cutting parameters

Enter the values as shown on the bottom left, overwriting the defaults (shown on the right).

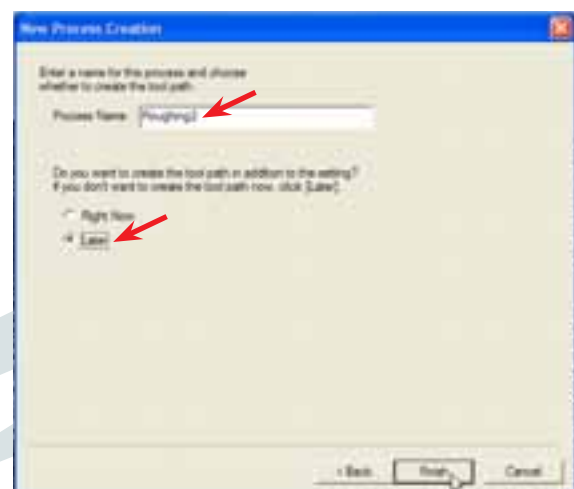
Click **NEXT**.

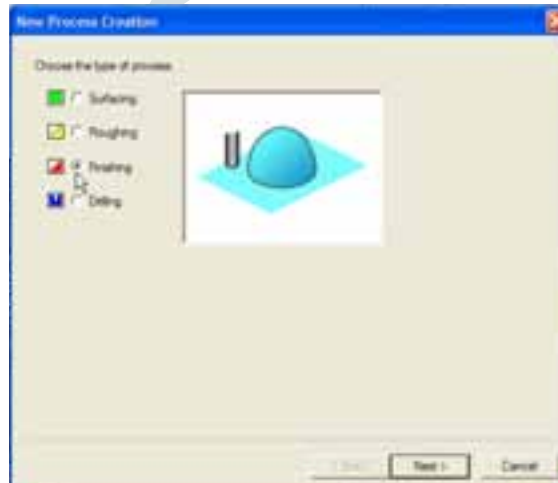


### STEP 45 Save Roughing process

Save the process as **Roughing2** and create tool path later.

Click **Finish** to close.



**STEP 46****Define Finishing on model**

Click on *New Process* icon to bring up this dialog box. Choose **Finishing** and click **NEXT**.

**STEP 47** Select cutting surface

When it comes to selecting the cutting surface, choose the **Bottom (-Z)** and click **NEXT**.

**STEP 48** Choose tool diameter

Select **R1.5 ball mill** from the tool drop-down list.

Click **NEXT**.

**STEP 49** Set depth

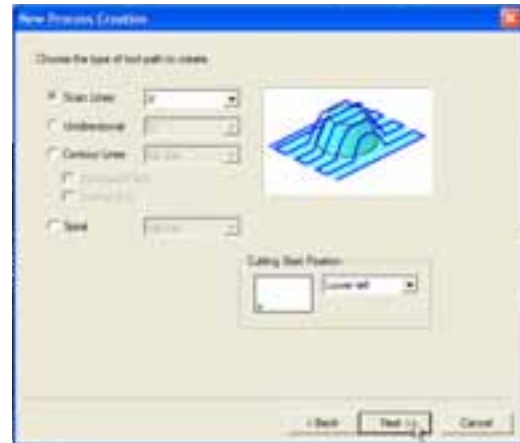
Click and drag the red line upwards to the somewhere in the middle of the model. To be precise, enter **End Height = -15 mm** instead.



**STEP 50** Set type of tool path

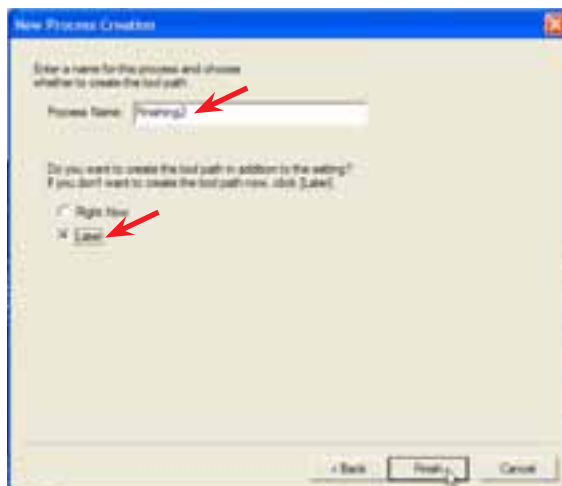
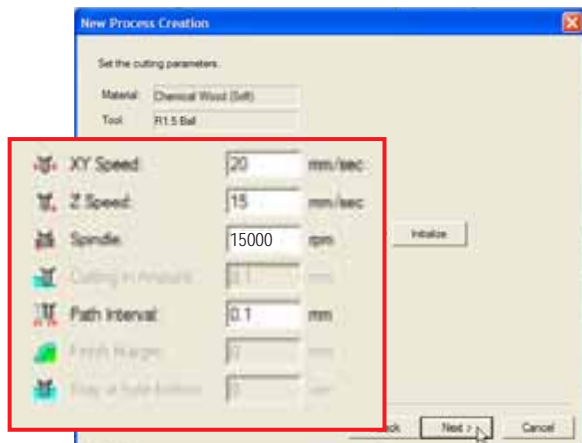
For creating type of tool path, choose **Scan Lines**. From the drop-down, select **X**.

Click **NEXT**.

**STEP 51** Set cutting parameters

Enter the values as shown on the bottom right, overwriting the defaults (shown on the left).

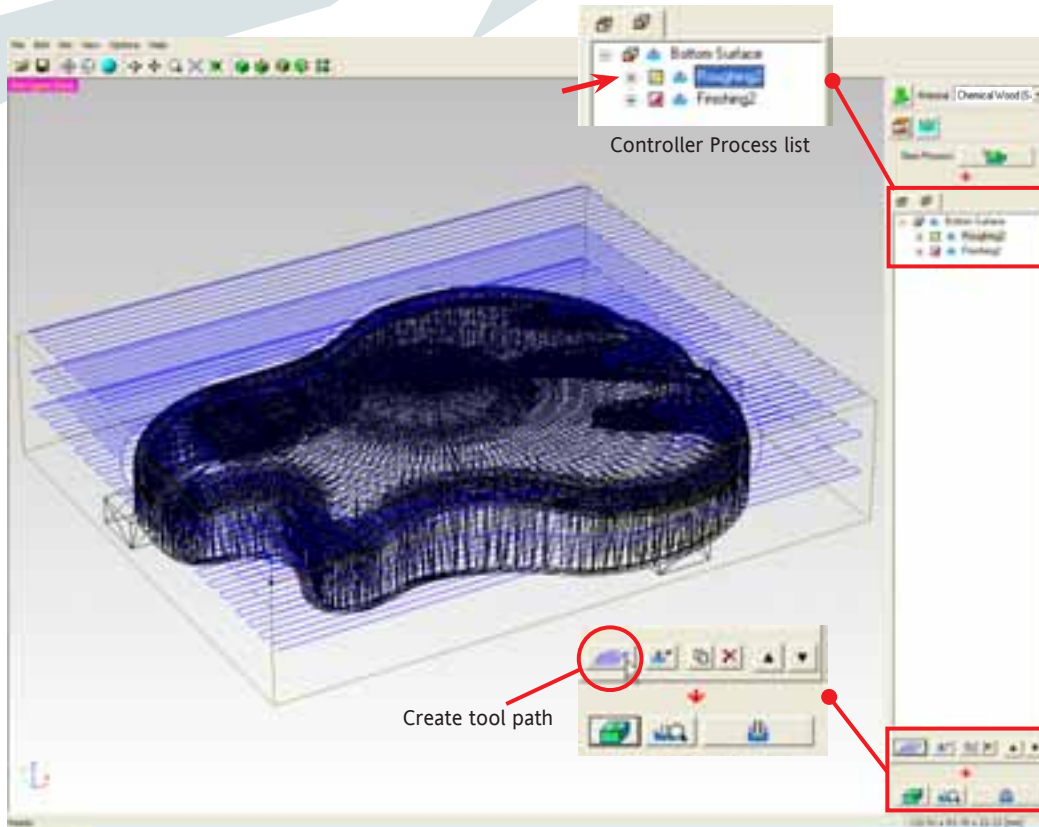
Click **NEXT**.

**STEP 52** Save Finishing process

Save the process as **Finishing2** and create tool path later.

Click **Finish** to close.

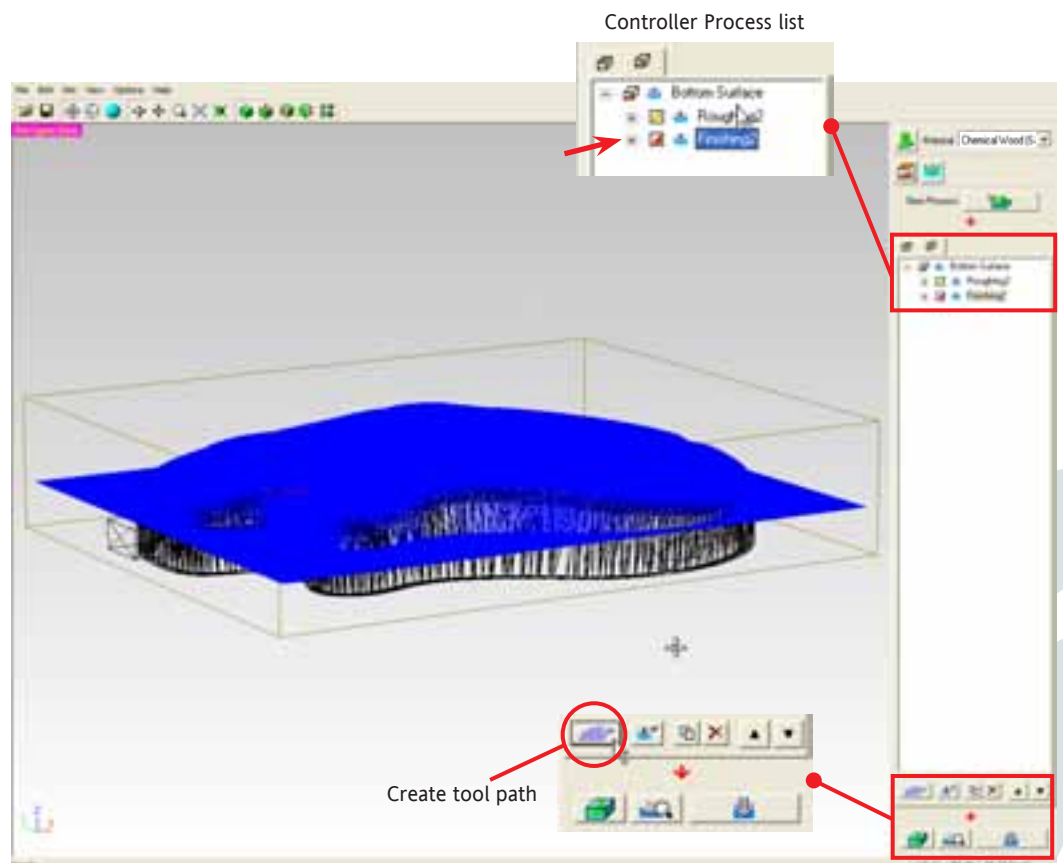
### STEP 53 Create tool path for Roughing



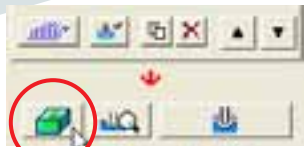
Back at the *Controller Process list*, select **Roughing2**. Then click on *Create tool path* icon below to generate a path for roughing.

### STEP 54 Create tool path for Finishing

Back at the *Controller Process list*, select **Finishing2**. Then click on *Create tool path* icon below to generate a path for roughing.



## STEP 55 Output cutting to MDX-40

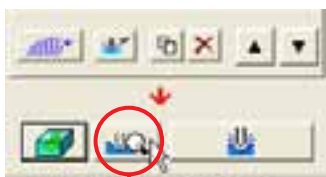
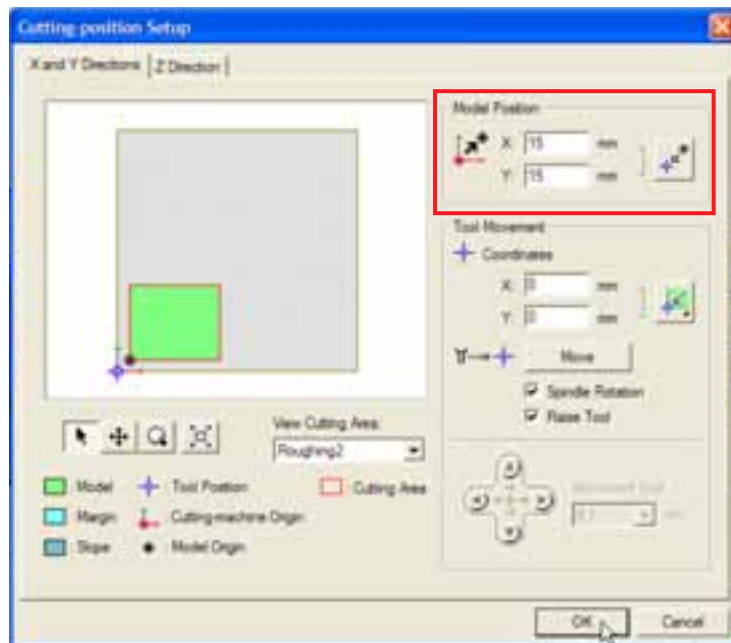


Cutting Position

Click on the *Cutting position* icon as shown. We need to set the cutting positions of our model.

In the *Cutting position Setup* dialog box, set a frame of **15 mm** for **X and Y**, under the *Model Position* section at the top right side.

Click **OK** to close.



Preview Cutting

Preview your 3D model before cutting by clicking on **Preview Cutting** button. This triggers the **Virtual Modela** utility program. Check on the time taken to cut for roughing and finishing respectively.

Click on the **Cut** tool at the bottom of the interface. This will be the final command to issue, where the data from the 3D model is sent to the MDX40 machine for cutting.

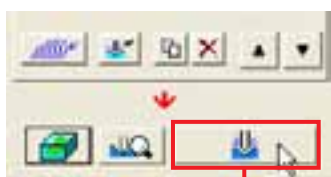
Click **OK** to cut.

A dialog box will keep track of the progress of cutting starting with **Roughing2** and **Finishing2**, through a progress bar.

Click **Continue** to proceed with cutting.

When everything is done, a message will inform you that the output is completed.

Click **OK** to close.



Cut



Photo showing **Roughing2** process completed using chemical wood as an example.



Photo showing **Finishing2** process completed using chemical wood as an example.

~~~ End of Example 2 ~~~

Material Mounting & Tool Zeroing

STEP 1 Material mounting

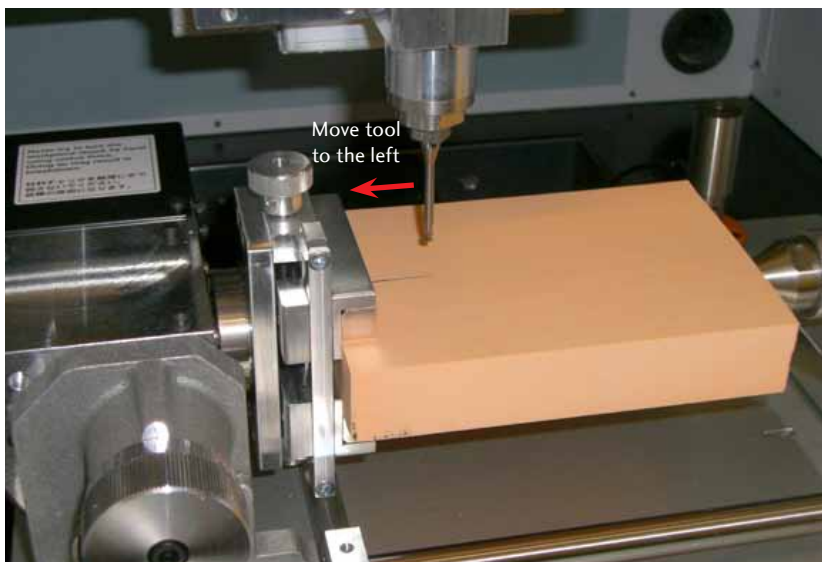
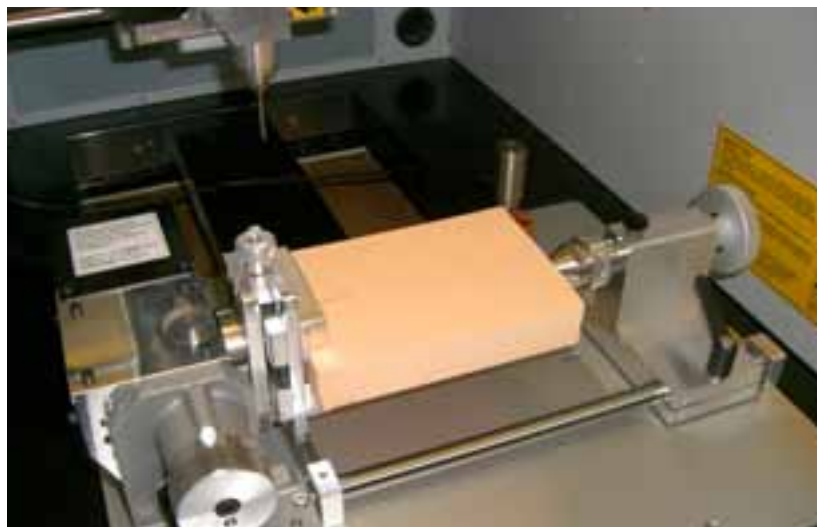


In the next example, we are using the rotary axis unit to cut our material. As such, we need to mount the Rotary Axis Unit onto Roland's MDX-40.

Mount a piece of chemical wood onto the rotary axis unit as shown. For instructions on how to complete the mounting, please refer to your Roland's MDX -40 user manual.

Photo showing material correctly mounted.

Please ensure the length of material is sufficient enough for the cutting to take place as allowance has to be given for the support on both sides of the model.



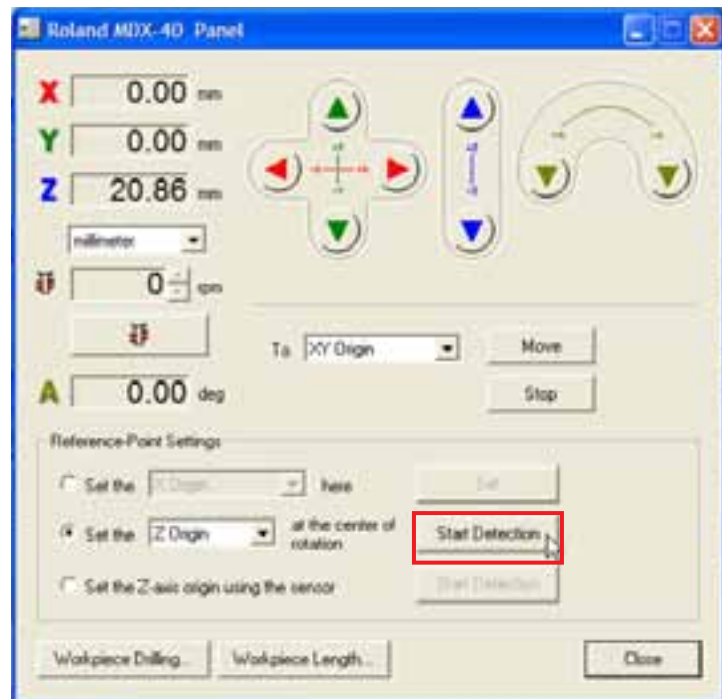
STEP 2 Tool positioning

Position cutting tool close to the left edge of the clamping device.

STEP 3 Detect Z origin

Under *Preference-Point Settings*, set the origin to **Z Origin**.

Then, click on **Start Detection** button.



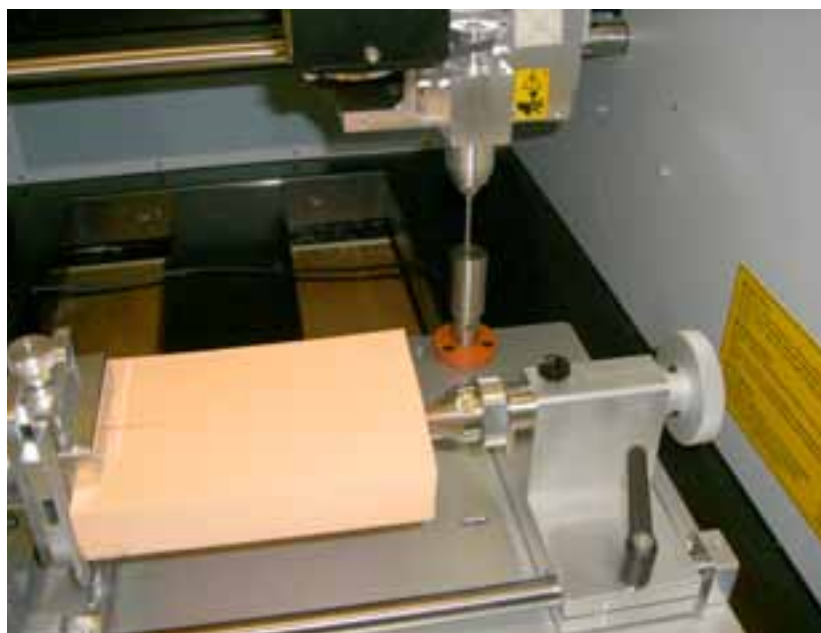
In the *Setup* dialog box, select **Continue** after ensuring a cutting tool has been installed on the spindle. The sensor is correctly placed.

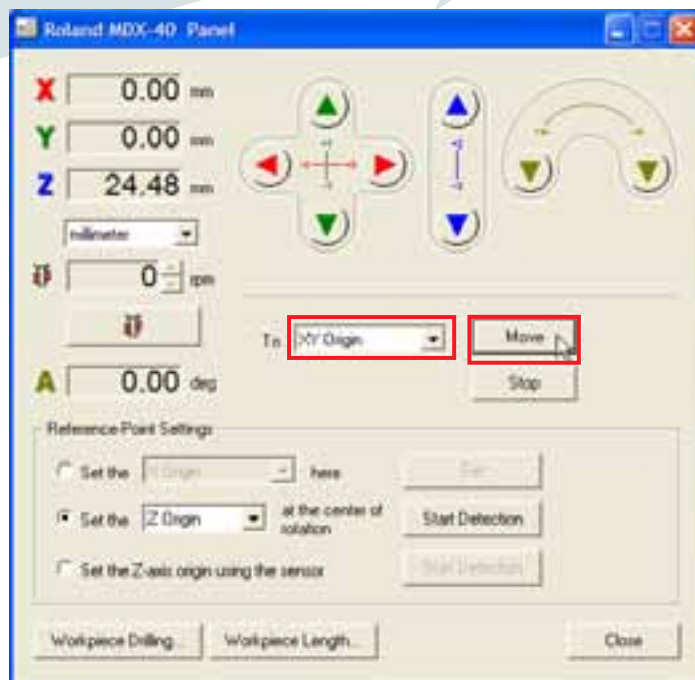
STEP 4

Set XY origin

Next, we have to set the XY origin of the tool.

Bring up the *Roland MDX-40 Panel* now.





Select **XY Origin** from the drop-down list as shown. Click **Move** button.

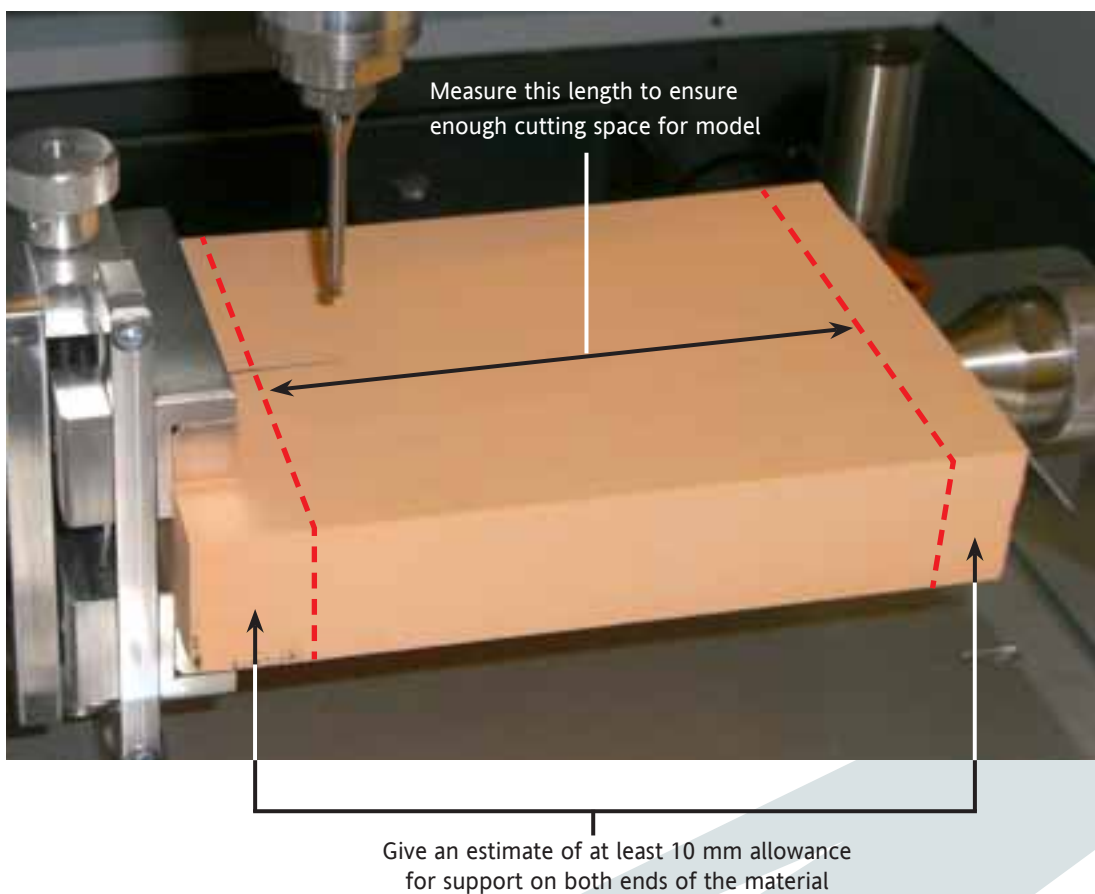
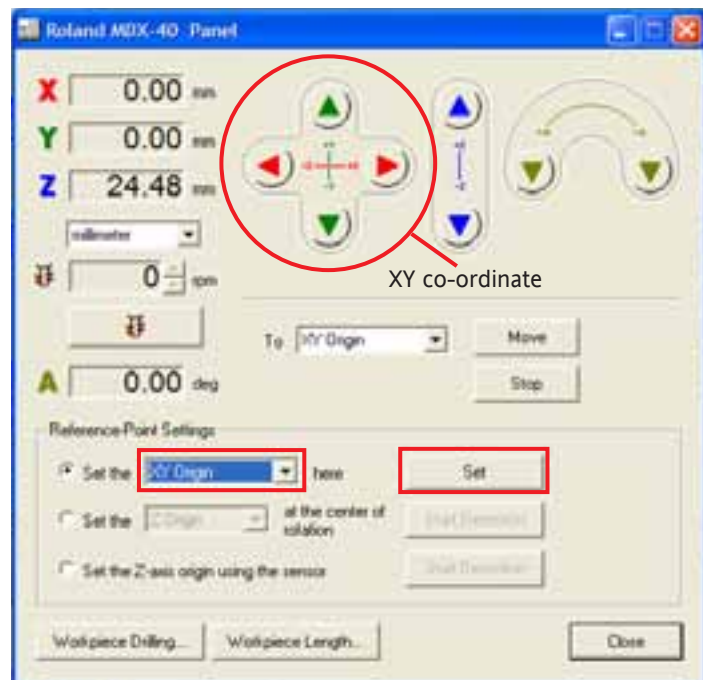


STEP 5**Detect origin**

Use the XY co-ordinate arrows to move the tool along the X -axis.

After ensuring there is enough length allowance for cutting the material (photos shown below), set the origin to **XY Origin** under *Reference-Point Settings*. Then click on the **Set** button.

Click **Close**.



Example 3 - Objective



To cut out a handphone using Roland's MDX40 rotary axis unit.



List of Items to Prepare for use

1. MDX-40 machine (Power up)
2. MDX-40 Rotary Axis Unit (mounted)
3. Example file *phone.stl*
(downloadable from Tutorials page, Freeform Digital website)
4. 1 piece of chemical wood cut to size (L135 mm x W80 mm x H24.06 mm)
5. R1.5 Ball mill cutting tool

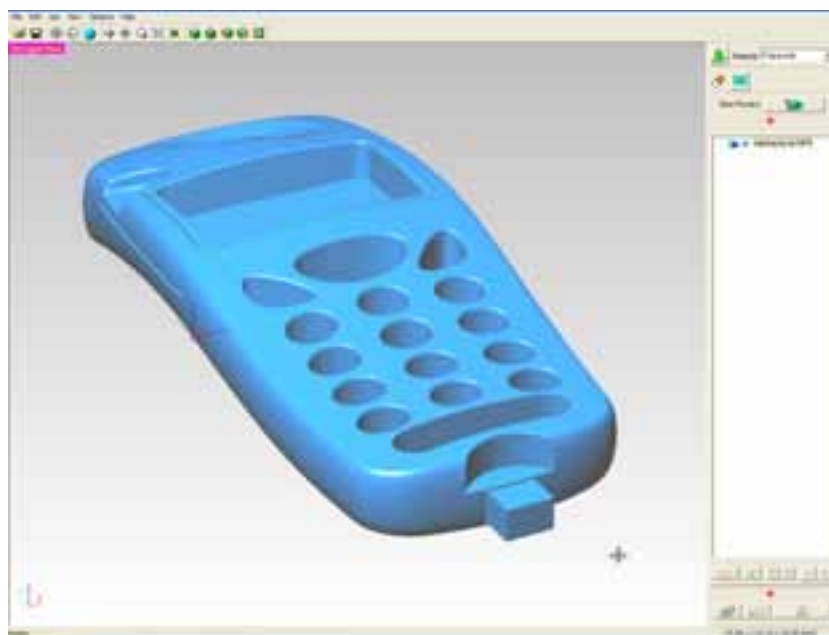
Example 3 - Phone

STEP 1 Open example file

Open a new file to work on. Go to **File > Open** from the top menu.

Navigate to your folder where a file named **phone.stl** is located.

Click **Open** the file. Render your 3D model. You should have the view as shown on the right.



STEP 2 Select Machine



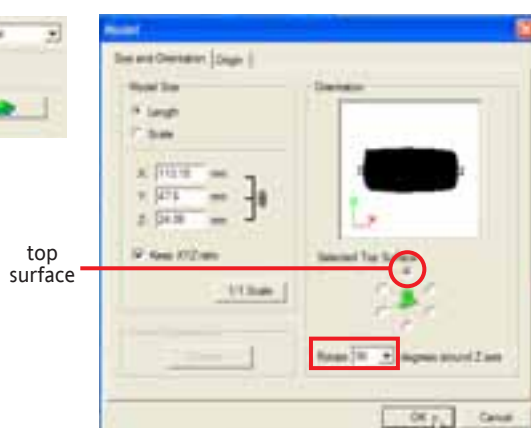
Go to **File > Select Machine**. Since we are going to cut a gear using the rotary axis option, we need to go to change an option. It will be different from the previous examples.



At the *Machine Selection* dialog box, ensure **MDX-40** model name is selected.

Check on the box next to *Rotary Axis Unit* option.

Click **OK** to close.

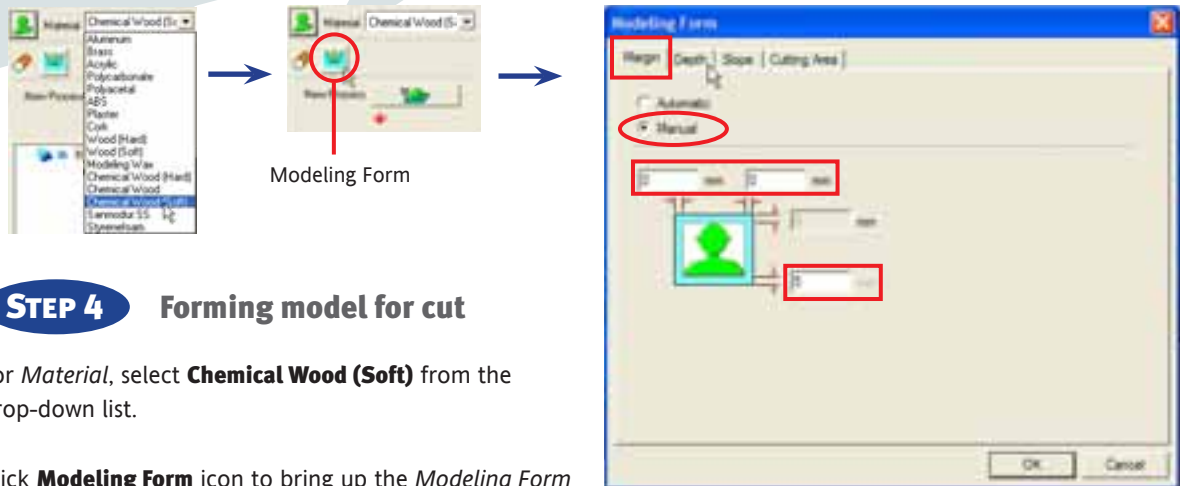


STEP 3 Layout 3D model

Click on **Model** icon as shown on the left. This will bring up the *Model* dialog box, where you need to set up the layout of your 3D model for cutting.

Under the *Orientation* section, select **top** surface for **Selected Top Surface**. Then select **90** degrees from drop-down list under **Rotate**.

Click **OK** to close.



STEP 4 Forming model for cut

For **Material**, select **Chemical Wood (Soft)** from the drop-down list.

Click **Modeling Form** icon to bring up the *Modeling Form* dialog box. Enter **X = 0 mm** on both X margins and **Y = 5 mm**. Click **OK** to continue.

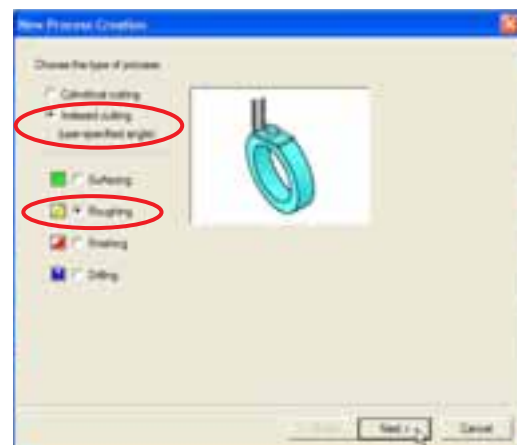


Click on **Depth** tag. Enter a value of **24.82 mm** in the *Depth* field. Click **OK** to continue.

We shall skip the **Slope** and **Cutting Area** tags as there are no changes needed.

STEP 5 Define Roughing on model

Click on *New Process* icon to bring up this dialog box. Choose **Indexed cutting** for the type of process and **Roughing**. Click **NEXT**.



STEP 6 Define angle of cut

Specify an angle of **0** degrees. If it is already at **0** degrees, continue by clicking **NEXT**.



STEP 7 Choose tool diameter



Select **R1.5 ball mill** from the tool drop-down list.

Click **NEXT**.

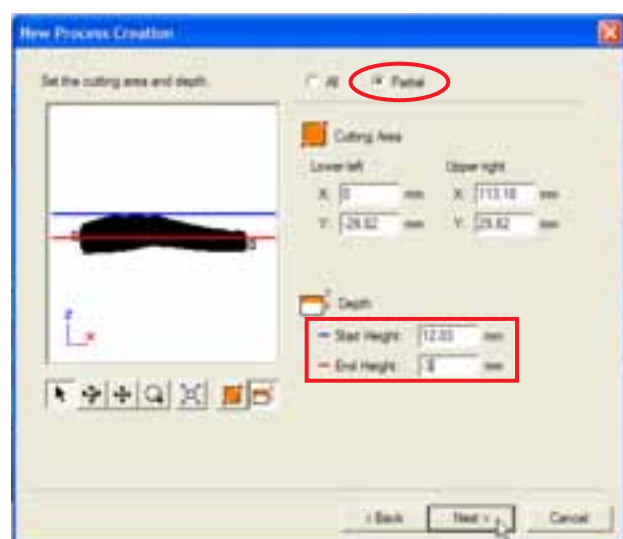
STEP 8 Set cutting area & depth

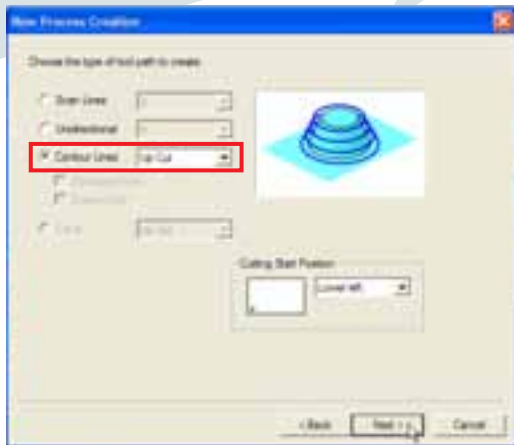
Select **Partial** option to allow manual input of values.



Change preview by clicking on *Change Depth* icon. Enter **Start Height = 12.03 mm** and **End Height = -3 mm**.

Click **NEXT**.

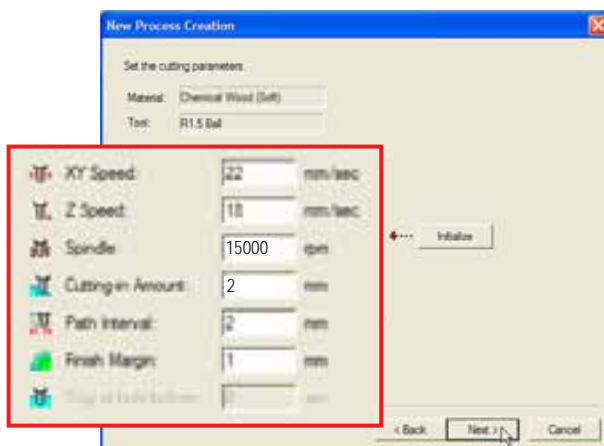




STEP 9 Set type of tool path

For creating type of tool path, choose **Contour Lines**. From the drop-down, select **Up Cut**.

Click **NEXT**.



STEP 10 Set cutting parameters

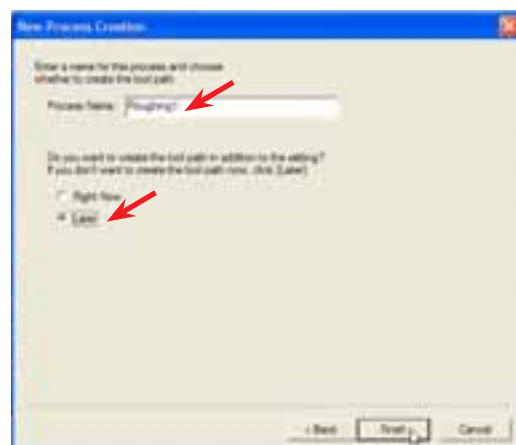
Enter the values as shown on the right, overwriting the defaults.

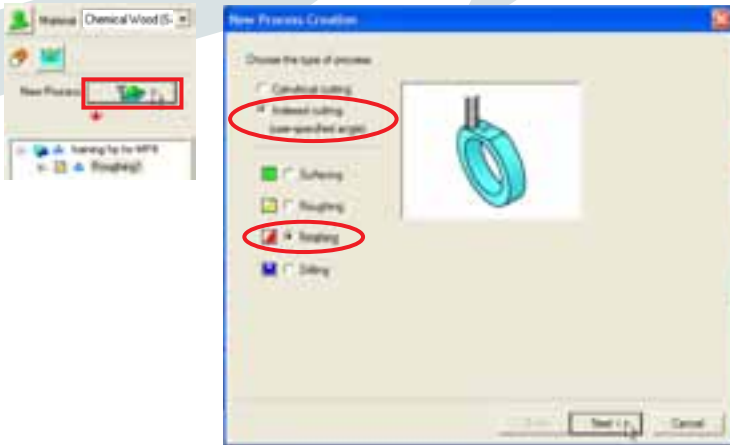
Click **NEXT**.

STEP 11 Save Roughing process

Save the process as **Roughing1** and create tool path later.

Click **Finish** to close.





STEP 12 Define Finishing on model

Click on *New Process* icon to bring up this dialog box. Choose **Index cutting** and **Finishing**

Click **NEXT**.

STEP 13 Define angle of cut

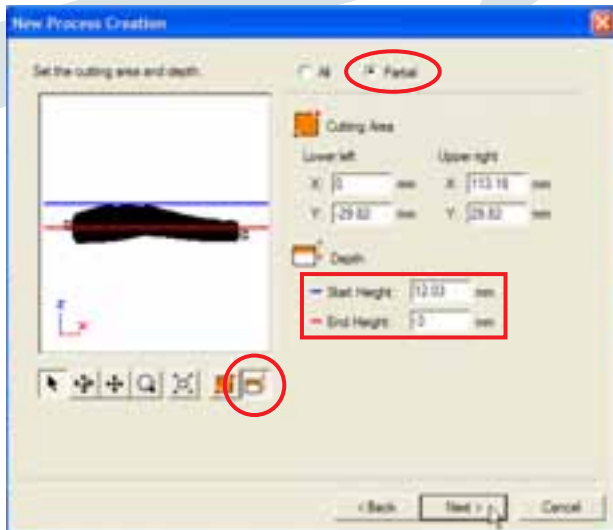
Specify an angle of **0** degrees. If it is already at **0** degrees, continue by clicking **NEXT**.



STEP 14 Choose tool diameter

Select **R1.5 ball mill** from the tool drop-down list.

Click **NEXT**.

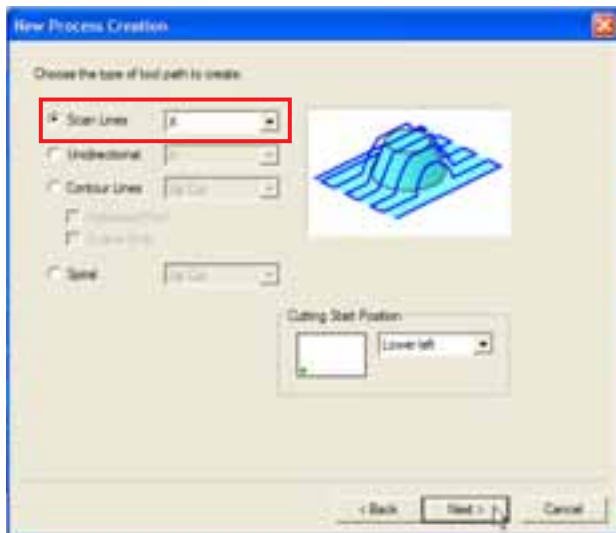


STEP 15 Set cutting area & depth

Select **Partial** option to allow manual inputs of values.

Change preview by clicking on *Change Depth* icon. Enter **Start Height = 12.03 mm** and **End Height = -3 mm**.

Click **NEXT**.



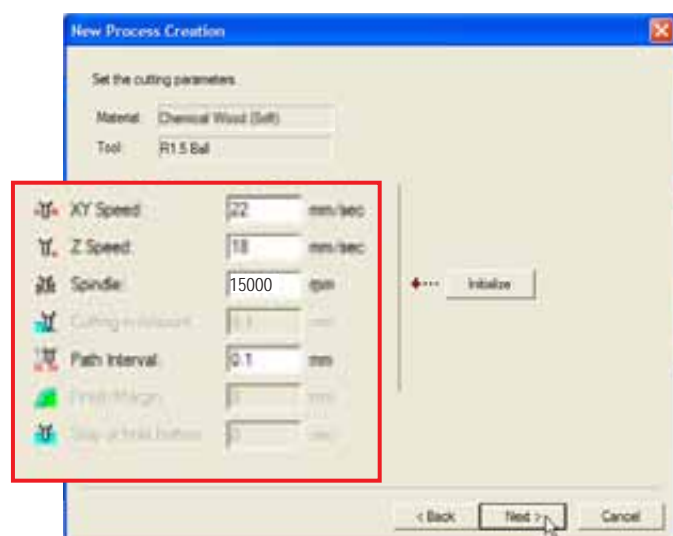
STEP 16 Set type of tool path

For creating type of tool path, choose **Scan Lines**. From the drop-down, select **X**.

Click **NEXT**.

STEP 17 Set cutting parameters

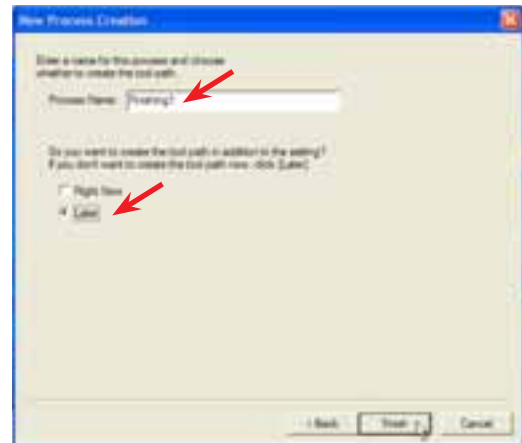
Enter the values as shown on the right, overwriting the defaults.



STEP 18 Save Finishing process

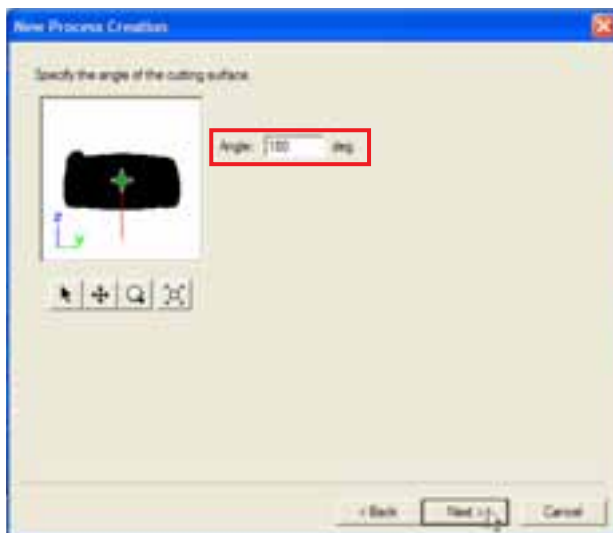
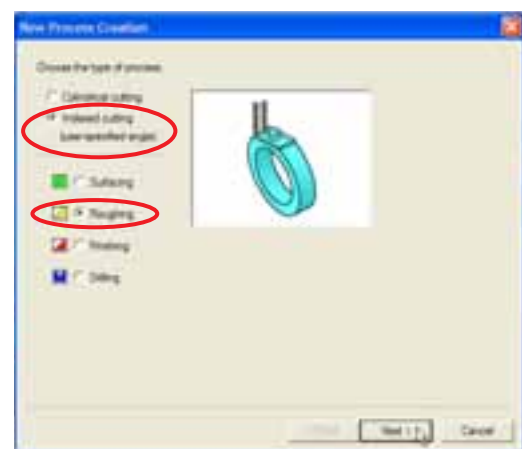
Save the process as **Finishing₁** and create tool path later.

Click **Finish** to close.

**STEP 19** Define Roughing on model

Click on *New Process* icon to bring up this dialog box. Choose **Indexed cutting** and **Roughing**.

Click **NEXT**.

**STEP 20** Define angle of cut

Specify an angle of **180** degrees. Click **NEXT**.

STEP 21 Choose tool diameter

Select **R1.5 ball mill** from the tool drop-down list.

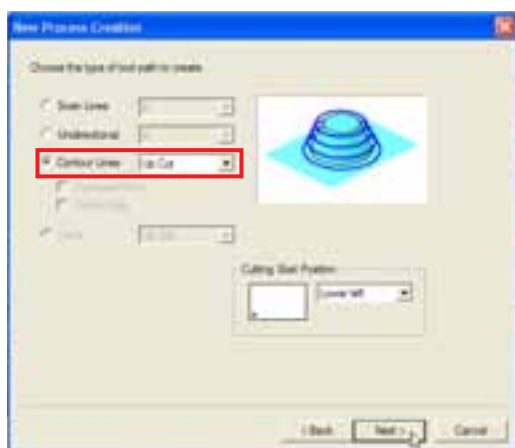
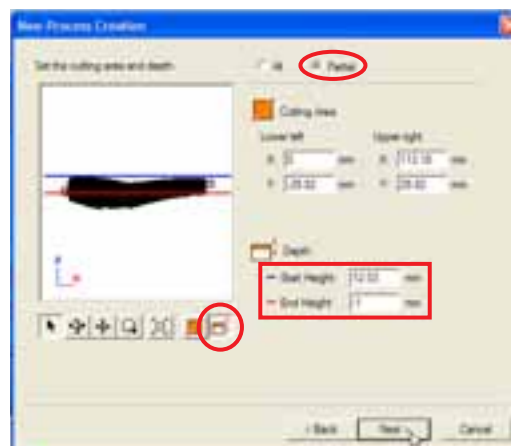
Click **NEXT**.



STEP 22 Set cutting area & depth

Select **Partial** option to allow manual inputs of values.
Change preview by clicking on *Change Depth* icon. Enter
Start Height = 12.03 mm and **End Height = -1 mm**.

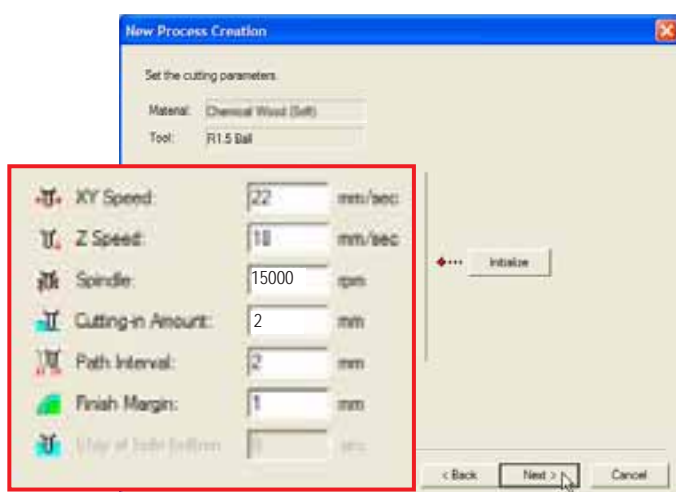
Click **NEXT**.



STEP 23 Set type of tool path

For creating type of tool path, choose **Contour Lines**. From the drop-down, select **Up Cut**.

Click **NEXT**.



STEP 24 Set cutting parameters

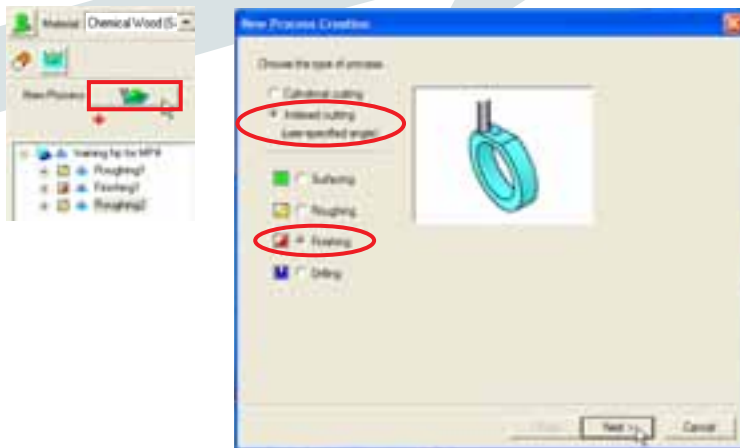
Enter the values as shown on the left, overwriting the defaults.

STEP 25 Save Roughing process

Save the process as **Roughing2** and create tool path later.

Click **Finish** to close.



**STEP 26****Define Finishing on model**

Click on *New Process* icon to bring up this dialog box. Choose **Index cutting** and **Finishing**.

Click **NEXT**.

**STEP 27** Define angle of cut

Specify an angle of **180** degrees.

Click **NEXT**.

STEP 28 Choose tool diameter

Select **R1.5 ball mill** from the tool drop-down list.

Click **NEXT**.

**STEP 29** Set cutting area & depth

Select **Partial** option to allow manual input of values.

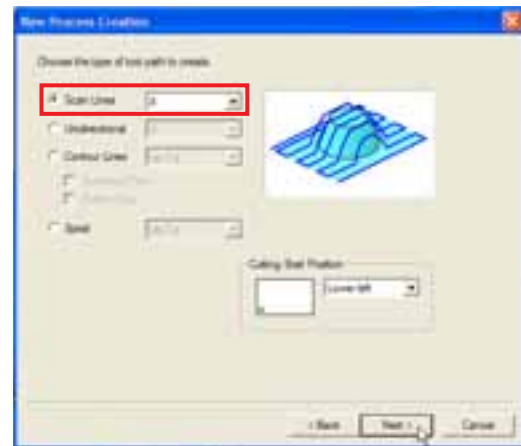
Change preview by clicking on *Change Depth* icon. Enter **Start Height = 12.03 mm** and **End Height = -1 mm**.

Click **NEXT**.

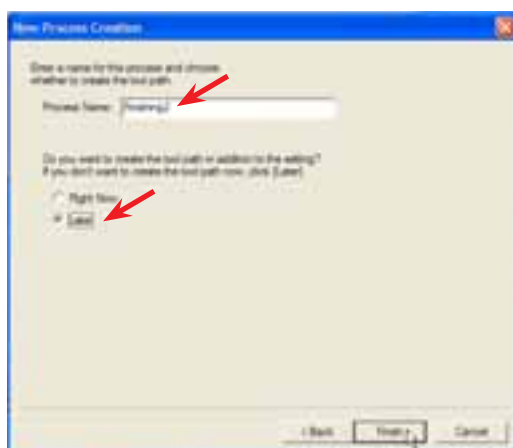
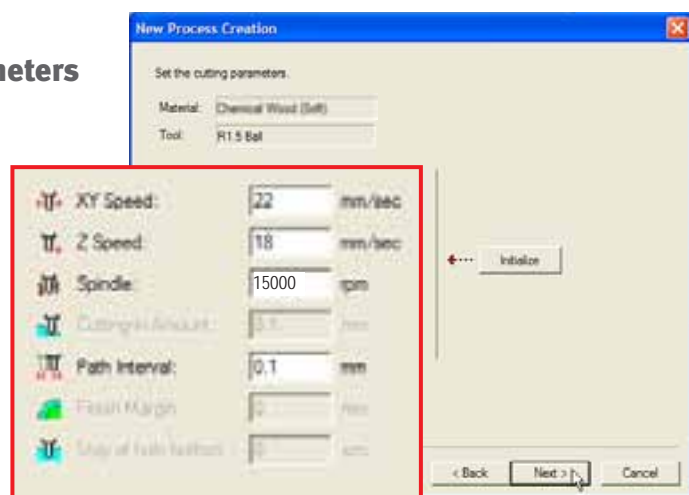
STEP 30 Set type of tool path

For creating type of tool path, choose **Scan Lines**. From the drop-down, select **X**.

Click **NEXT**.

**STEP 31** Set cutting parameters

Enter the values as shown on the right, overwriting the defaults.

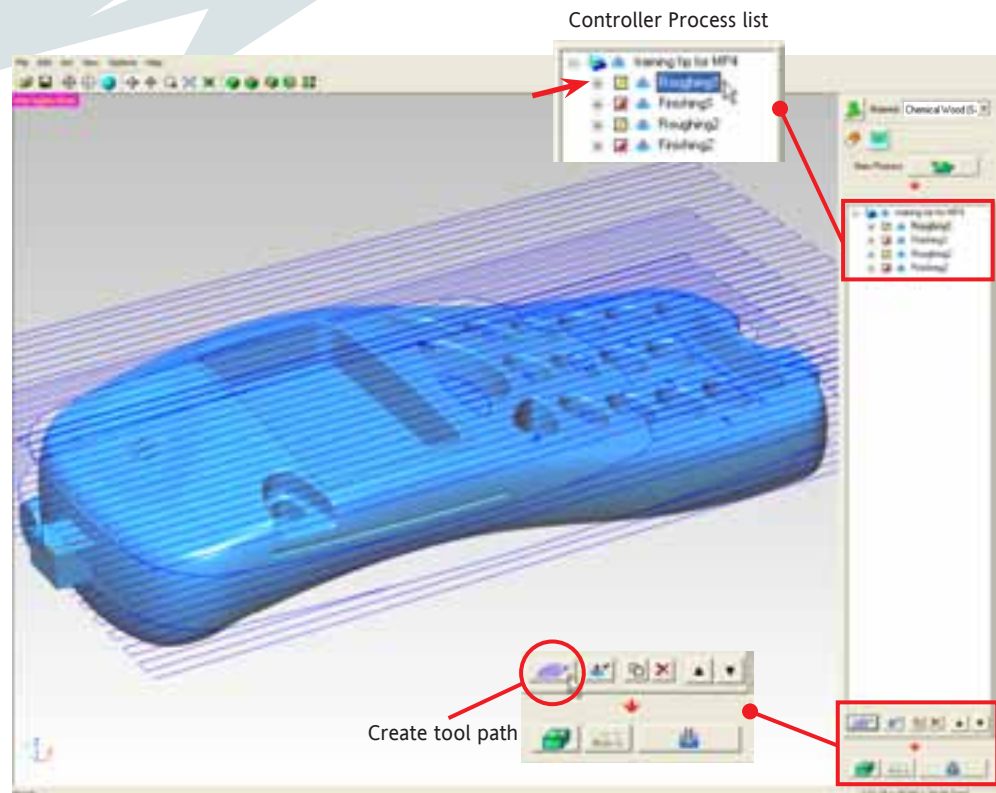
**STEP 32** Save Roughing process

Save the process as **Roughing1** and create tool path later.

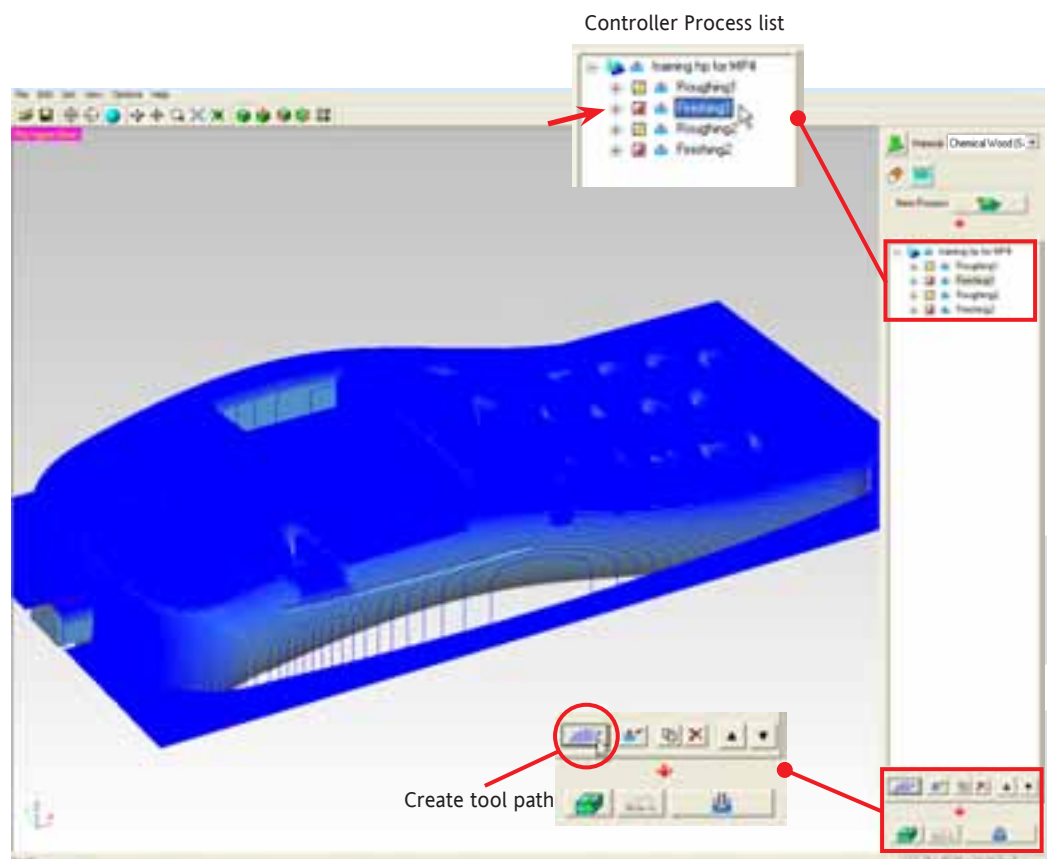
Click **Finish** to close.

STEP 33**Create tool path for Roughing**

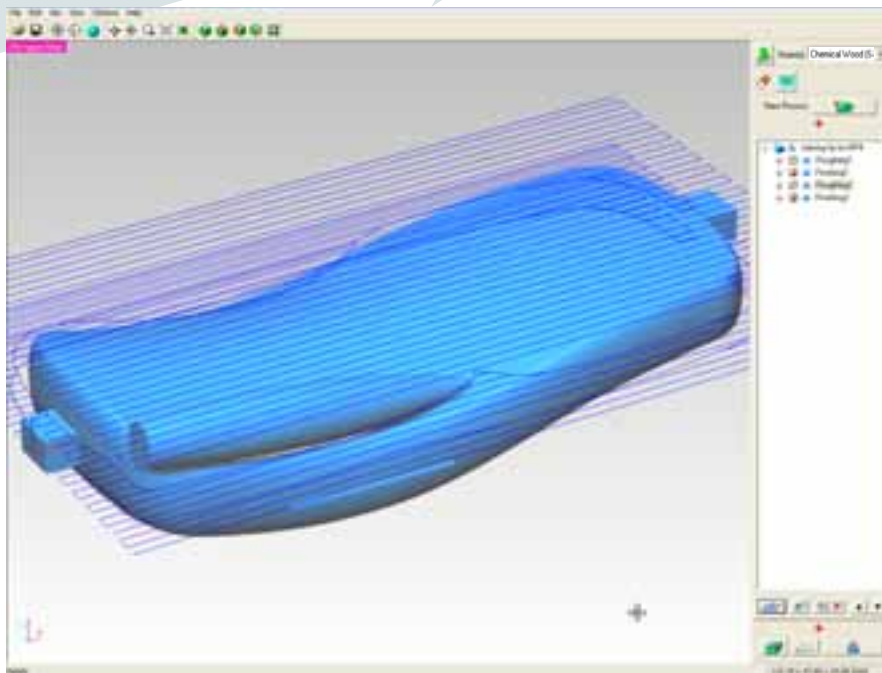
Back at the *Controller Process list*, select **Roughing1**. Then click on *Create tool path* icon below to generate a path for roughing.

**STEP 34****Create tool path for Finishing**

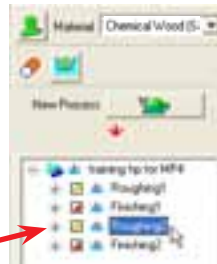
Select on **Finishing1** in the *Controller Process list*. Click on *Create tool path* icon below to generate a path for finishing.



STEP 35 Create tool path for Roughing



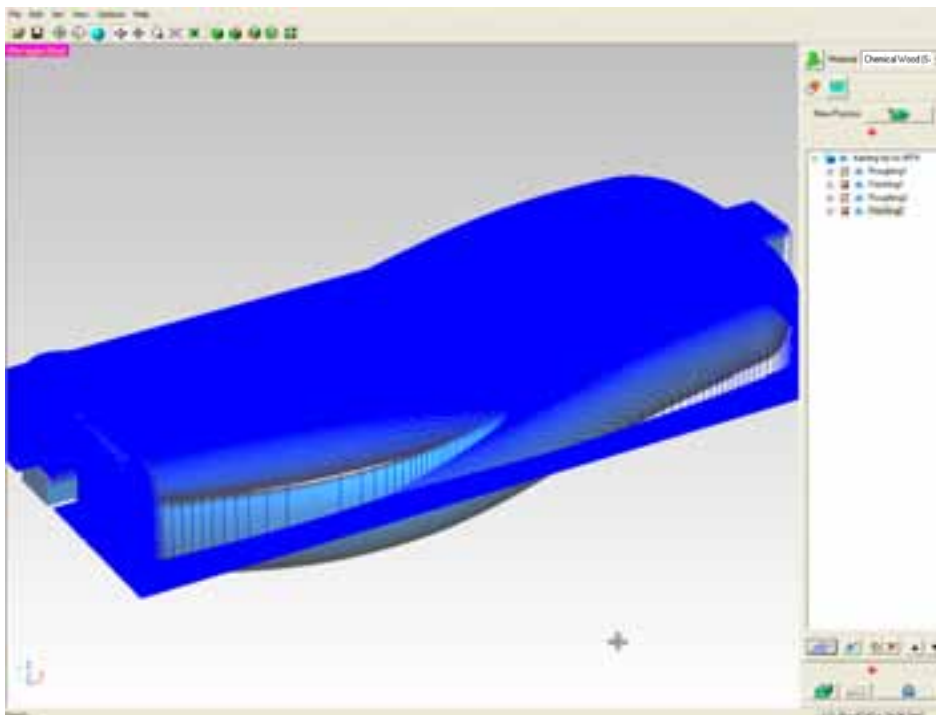
Controller Process list



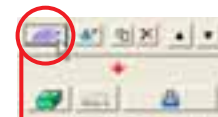
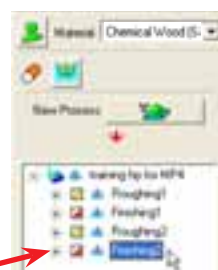
Create tool path

Repeat the same procedure for **Roughing2** and **Finishing2** processes as well. At the *Controller Process list*, select **Roughing2**. Then click on *Create tool path* icon to generate a path for roughing.

STEP 36 Create tool path for Finishing

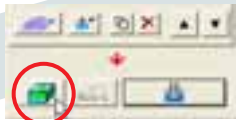


Controller Process list

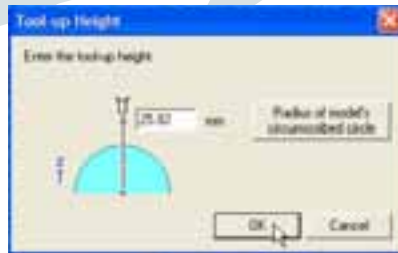


Create tool path

Select on **Finishing2** in the *Controller Process list*. Click on *Create tool path* icon to generate a path for finishing.



Cutting Position

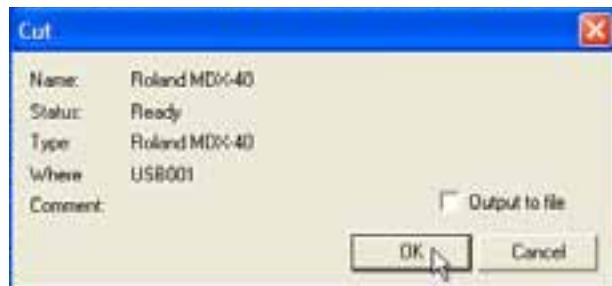
**STEP 37** Set Tool-up height

On selecting the *Cutting Position* icon, the *Tool-up Height* dialog box appears. A safe height value will be displayed here.

Accept the given value and click **OK** to close.

STEP 38 Output cutting to MDX-40

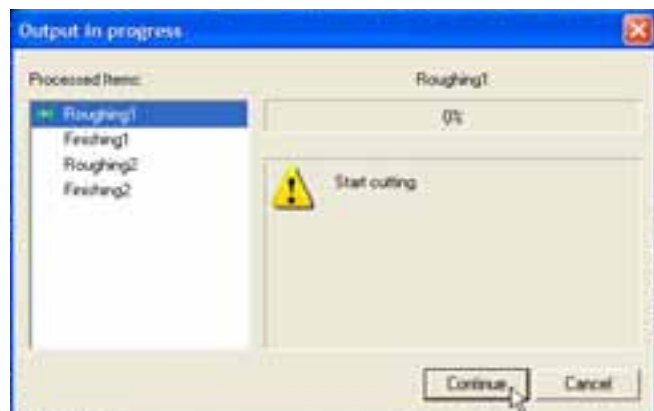
Cut



Click on the *Cut* tool at the bottom of the interface. This will be the final command to issue, where the data from the 3D model is sent to the MDX40 machine for cutting. Click **OK** to cut.

A dialog box will keep track of the progress of cutting starting with **Roughing1** and **Finishing1**, through a progress bar.

Click **Continue** to proceed with cutting.



Observe that the order as it goes through the different cutting processes.

When everything is done, a message will inform you that the output is done.

Click **OK** to close.





Photos showing completion of **Roughing** and **Finishing** processes for the **front** part of the phone model.

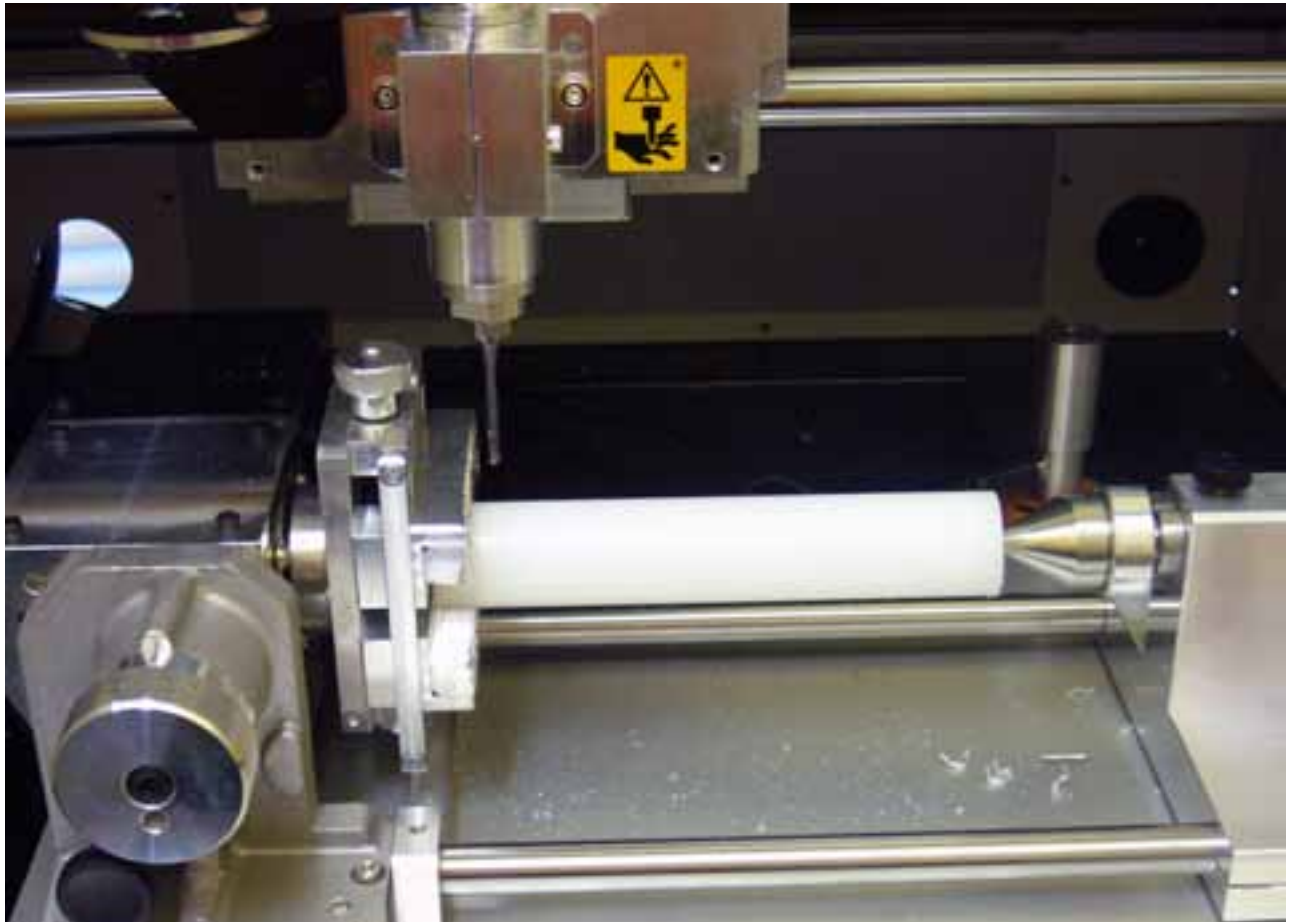


Photos showing completion of **Roughing** and **Finishing** processes for the **back** part of the phone model.

~~~ End of Example 3 ~~~

## Material Mounting & Tool

For detailed instructions as to how we do the mounting the unit and the material, please refer to Roland's manual that comes with the package.



## Example 4 - Objective



To cut out a cylindrical worm using Roland's MDX40 rotary axis unit.

## List of Items to Prepare for use

1. MDX-40 machine (Power up)
2. MDX-40 Rotary Axis Unit (mounted)
3. Example file *rotary\_worm.stl*  
(downloadable from Tutorials page, Freeform Digital website)
4. 1 piece of cylindrical wax material cut to size (L135 mm x Diameter 25 mm)
5. R1.5 Ball mill cutting tool



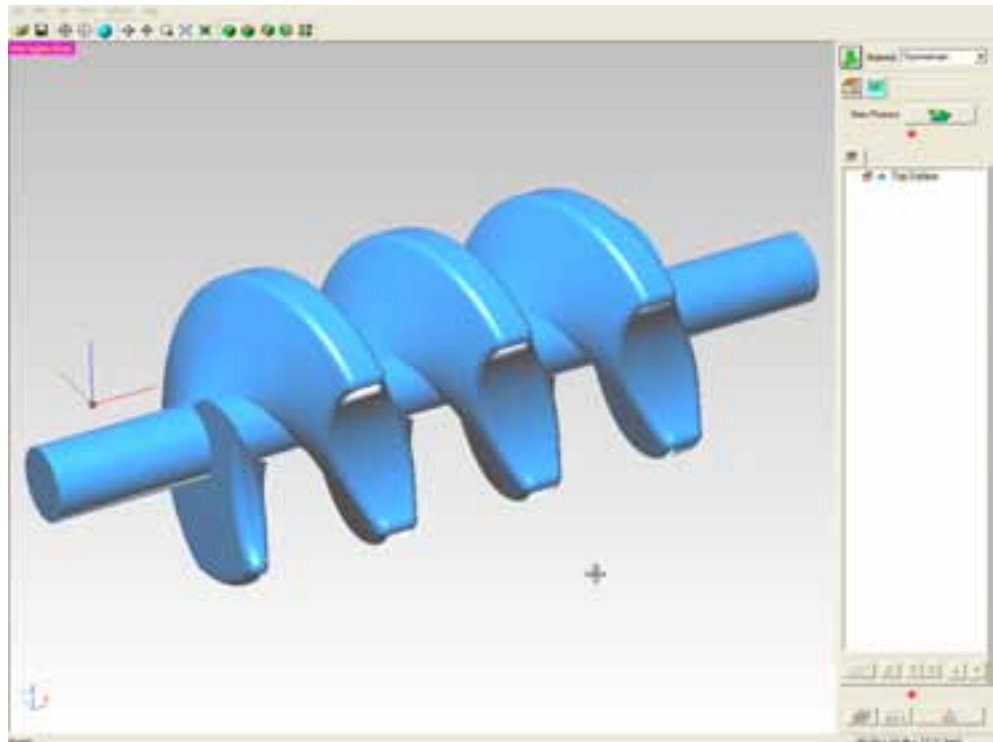
## Example 4 - Worm

### STEP 1 Open example file

Open a **rotary\_worm.stl** from your folder on the desktop.

This time, we are going to use the rotary axis to cut this 3D model. There are some subtle changes to the dialog settings that we will be using.

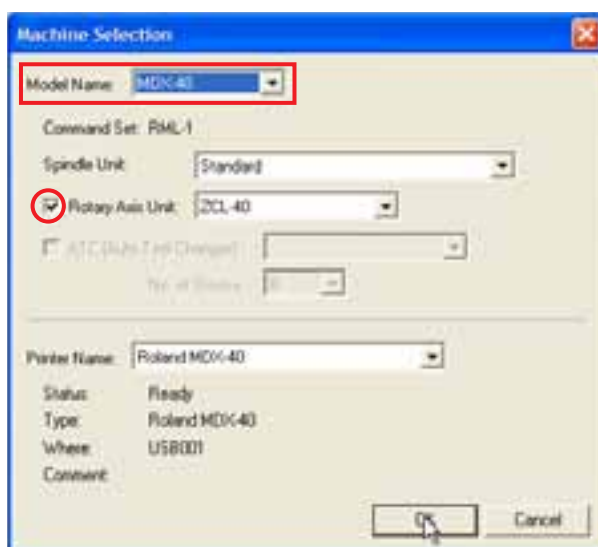
Render the model to get the view on the right.



### STEP 2 Select Machine



Go to **File > Select Machine**. Since we are going to cut a gear using the rotary axis option, we need to go to change an option. It will be different from the previous examples.

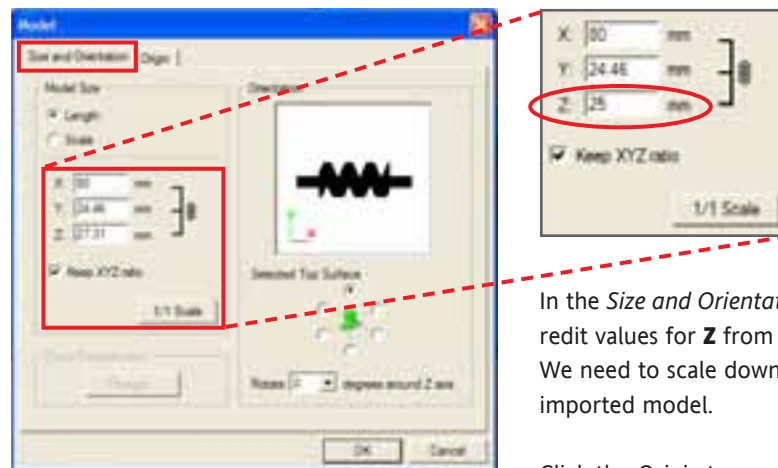
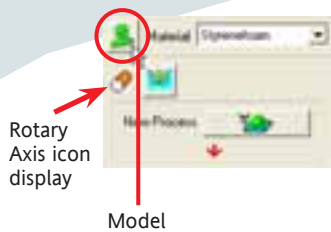


At the *Machine Selection* dialog box, ensure **MDX-40** model name is selected.

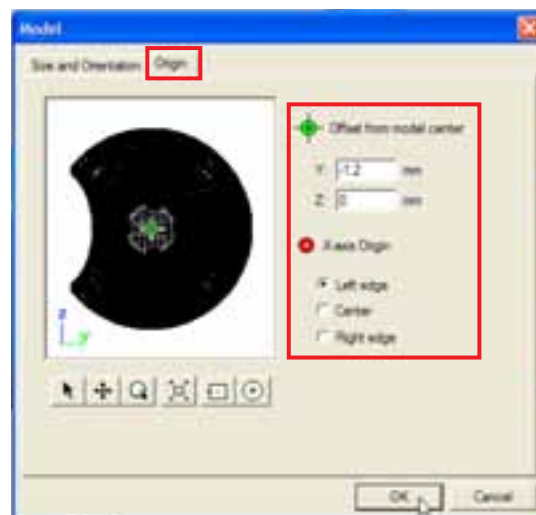
Check on the box next to *Rotary Axis Unit* option.

Click **OK** to close.

### STEP 3 Set Model Origin

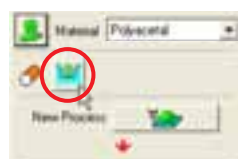
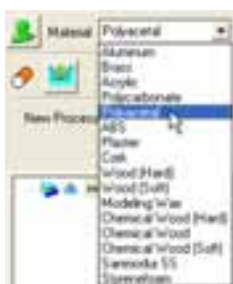


Click the *Origin* tag next.



\*see **Appendix B** for more explanations

### STEP 4 Set material and modeling form



Select **Polyacetal** material in the drop-down list. Next, click on *Modeling Form* icon shown on the left to define the modeling form.



## STEP 5 Set Depth for model

In the *Depth* tag, the *Preview* - displays the cutting-depth locations. It lets you check the depths to which the model is cut.

To change the depth, drag the red line up or down.

You can also rotate, move, or zoom the view, or fit it to the screen.

**Depth** - the cutting depth from the circle circumscribed around the model. Negative values cannot be entered.

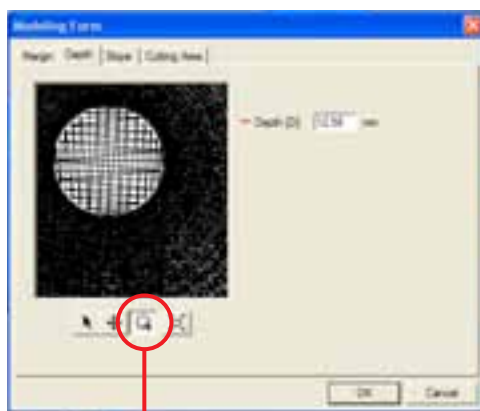
This determines the approach limit for the tool. *Note* that making the depth greater than the thickness of the workpiece may cause the model to be cutoff during cutting.

This cannot be set deeper than the centre of rotation.

When the workpiece is secured in place using a core rod, the depth is limited to keep the core rod from being cut.

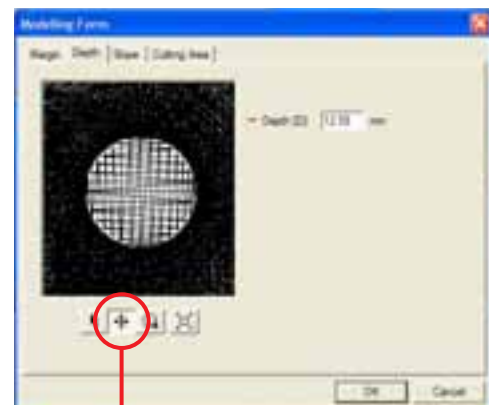


Selection tool



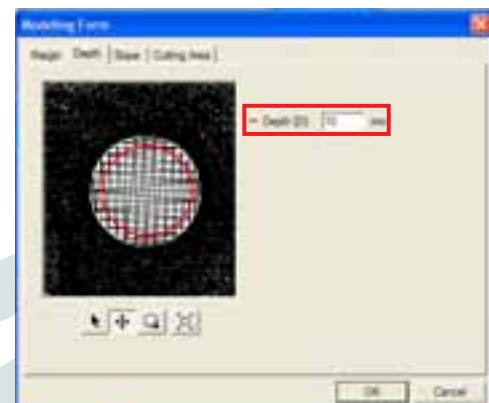
Zoom tool

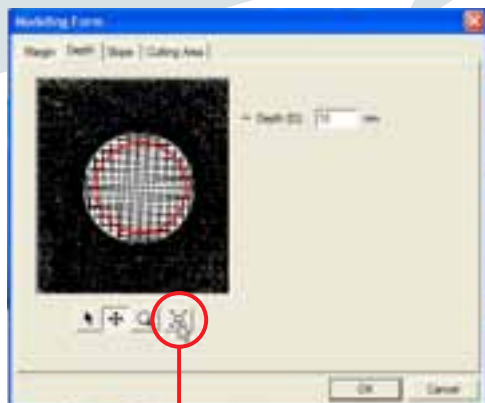
You can zoom and move using the tools below the *Preview* screen.



Move tool

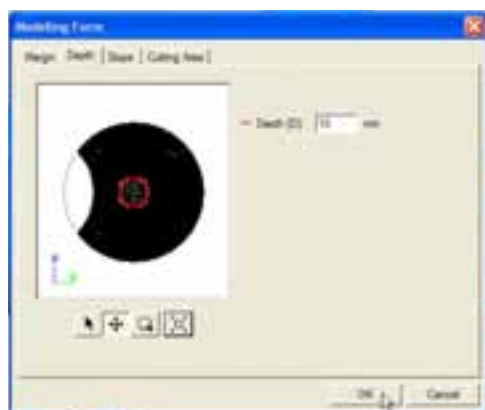
Enter **Depth = 10 mm**. You should see a circle depicting the depth of the cutting in the *Preview*.





Enlarge/Reduce  
view tool

Click on the *Enlarge/Reduce* view tool to enable 1:1 preview of the model.



Once done, let's continue by clicking on the rest of the tags.

## STEP 6

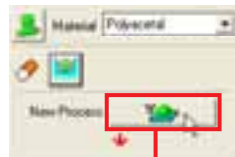
Let's skip on the *Slope* tag as there is nothing to be changed. At the *Cutting Area* tag, accept the defaults.

Click **OK** to close.

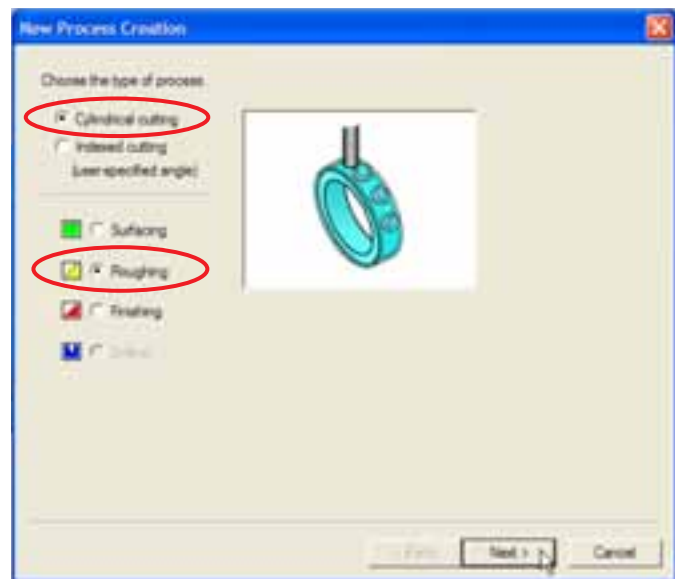


## STEP 7 Define Roughing on model

Click on **New Process** icon to bring up this dialog box. Choose **Cylindrical cutting** and **Roughing** and click **NEXT**.



New Process



## STEP 8 Choose tool diameter

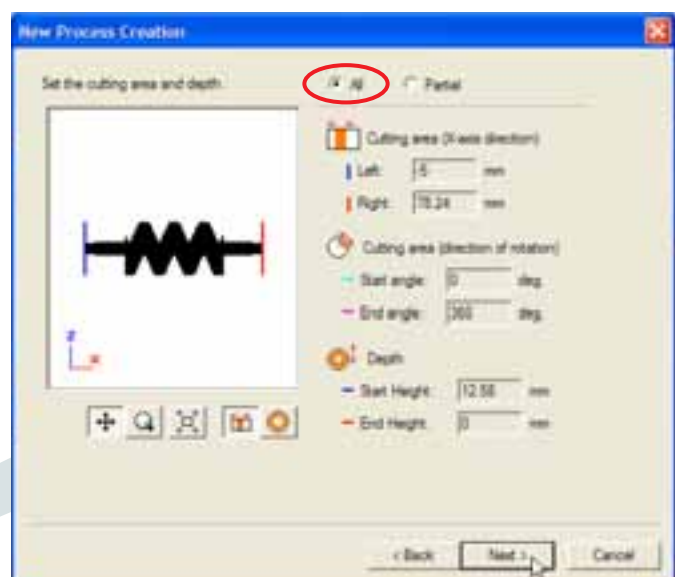
Select **R1.5 ball mill** from the tool drop-down list.

Click **NEXT**.

## STEP 9 Set cutting area & depth

Select **All** option for setting area and depth.

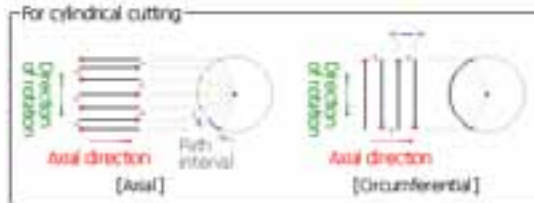
Accept the default settings and click **NEXT**.





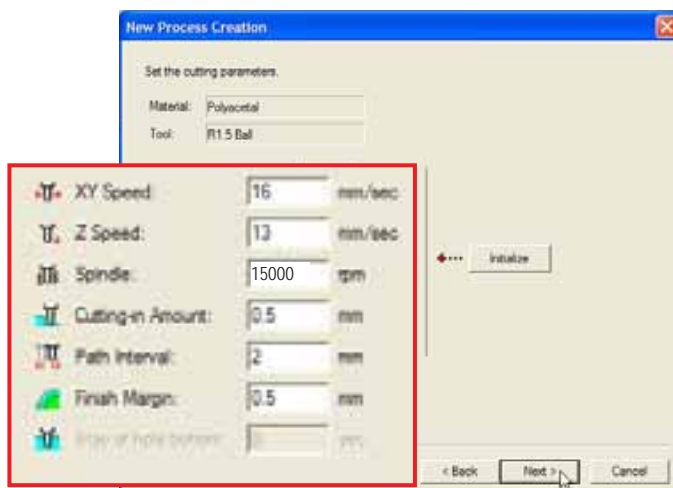
## STEP 10 Set type of tool path

**Axial** - is the distance at the circumference circumscribed about the model.



For creating type of tool path, choose **Unidirectional**. From the drop-down, select **Axial**.

Click **NEXT**.



## STEP 11

### Set cutting parameters

Enter the values as shown on the left, overwriting the defaults.

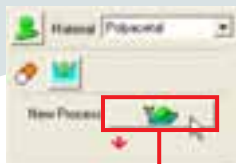
Click **NEXT**.

## STEP 12 Save Roughing process

Save the process as **Roughing1** and create tool path later.

Click **Finish** to close.





New Process

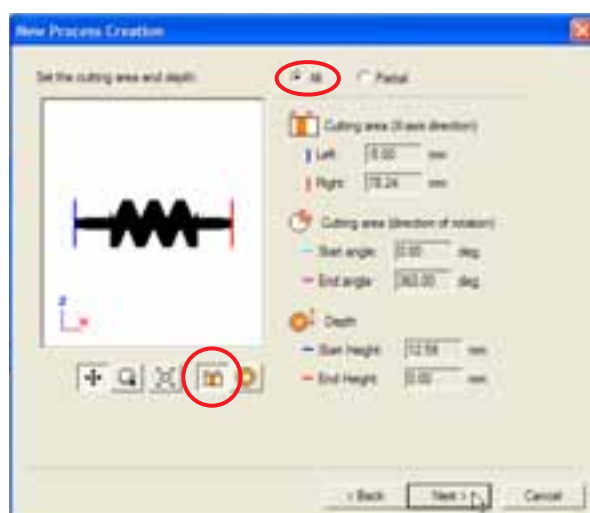
**STEP 13****Define Finishing on model**

Click on *New Process* icon to bring up this dialog box. Choose **Cylindrical cutting** and **Finishing** and click **NEXT**.

**STEP 14 Choose tool diameter**

Select **R1.5 ball mill** from the tool drop-down list.

Click **NEXT**.

**STEP 15 Set cutting area & depth**

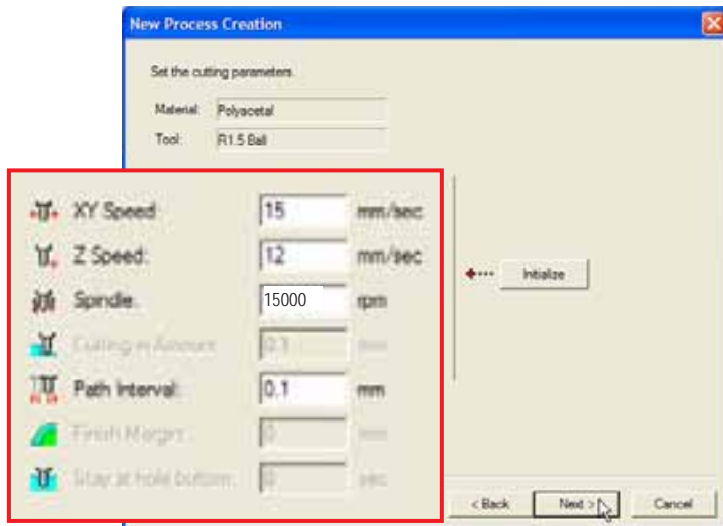
Select **All** option for setting area and depth.

Accept the default settings and click **NEXT**.

### STEP 16 Set type of tool path

For creating type of tool path, choose **Scan Lines**. From the drop-down, select **Circumferential**.

Click **NEXT**.



### STEP 17 Set cutting parameters

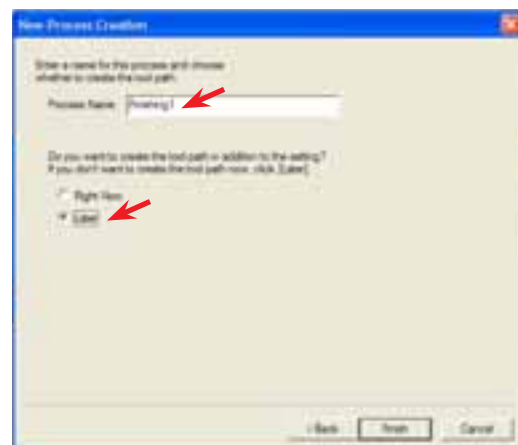
Enter the values as shown on the left, overwriting the defaults.

Click **NEXT**.

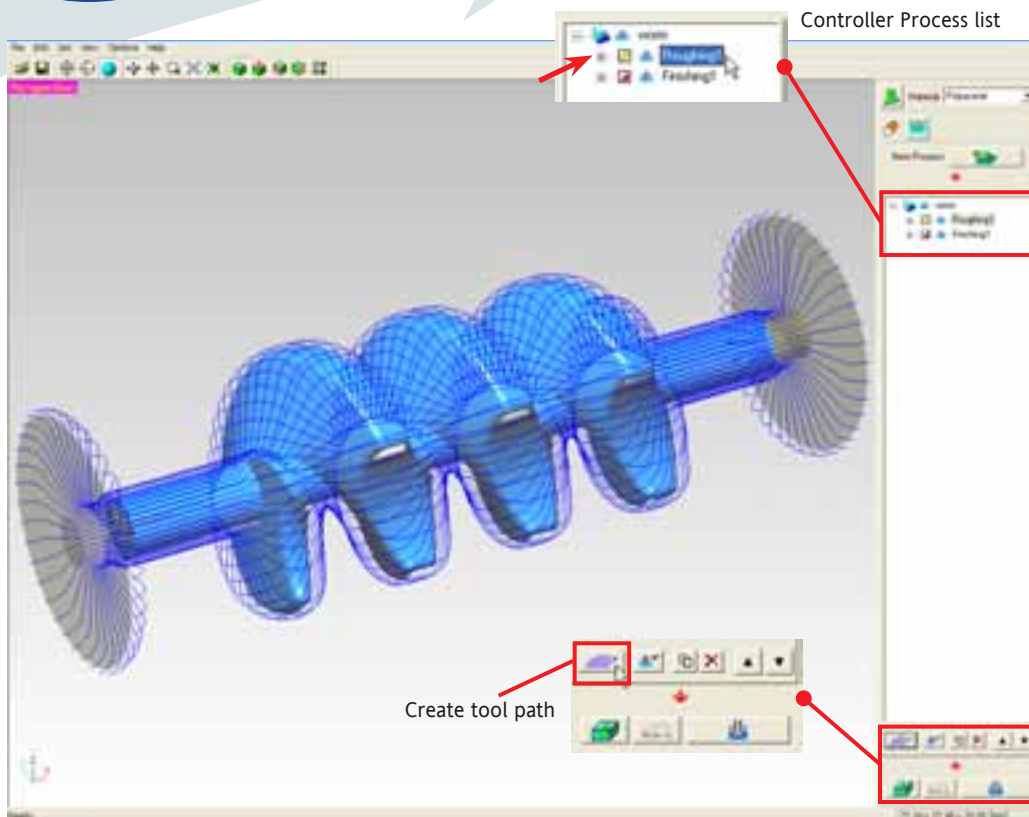
### STEP 18 Save Finishing process

Save the process as **Finishing1** and create tool path later.

Click **Finish** to close.



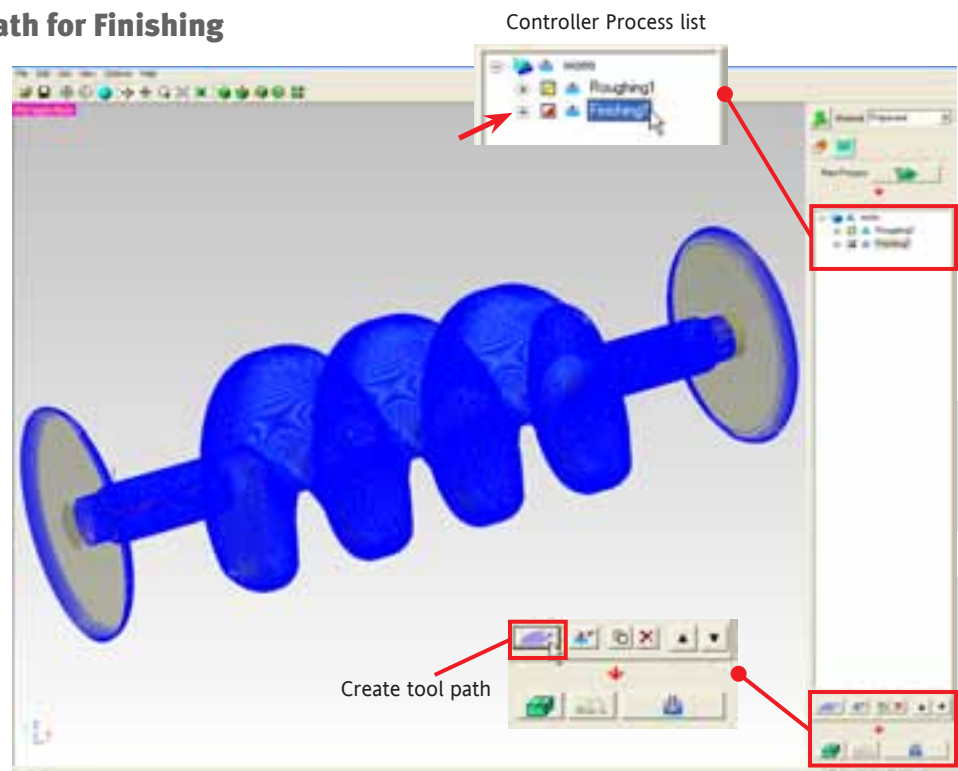
### STEP 19 Create tool path for Roughing



Back at the *Controller Process list*, select **Roughing1**. Then click on *Create tool path* icon below to generate a path for roughing.

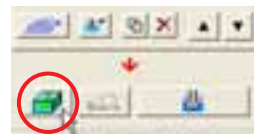
### STEP 20 Create tool path for Finishing

Select on **Finishing1** in the *Controller Process list*. Click on *Create tool path* icon below to generate a path for finishing.

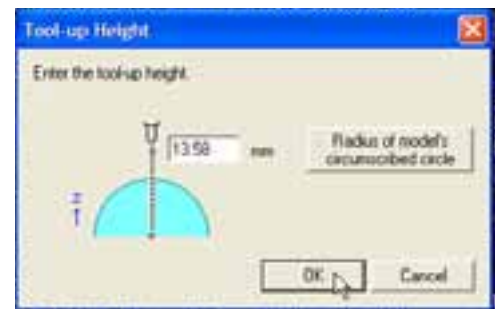


## STEP 21 Set Tool-up height

On selecting the *Cutting Position* icon, the *Tool-up Height* dialog box appears. A safe height value will be displayed here. You can either enter a value higher than the value given here and accept the defaults. If you try entering a lower value than that, it will prompt you an error message. You shall be required to re-enter a correct value again.\*



Cutting Position



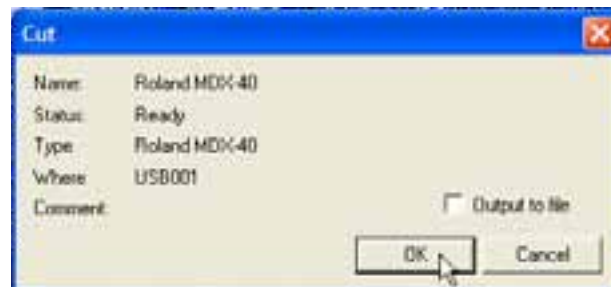
\*see **Appendix B** for more explanations

Click **OK** to close.

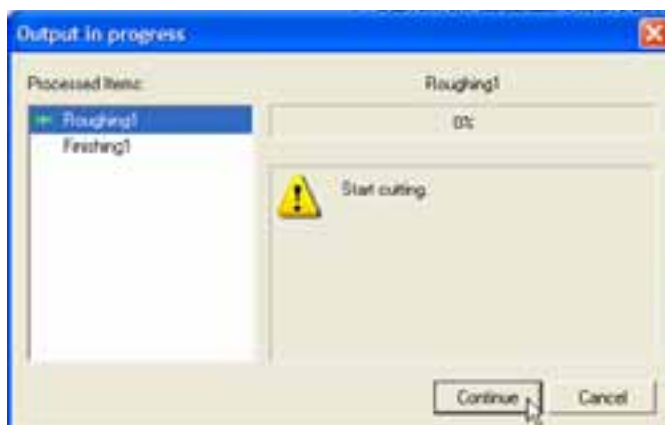
## STEP 22 Output cutting to MDX-40



Cut



Click on the *Cut* tool at the bottom of the interface. This will be the final command to issue, where the data from the 3D model is sent to the MDX40 machine for cutting. Click **OK** to cut.



A dialog box will keep track of the progress of cutting starting with **Roughing1** and **Finishing1**, through a progress bar.

Click **Continue** to proceed with cutting.





When everything is done, a message will inform you that the output is done.

Click **OK**.

Photo showing **Roughing** process completed.

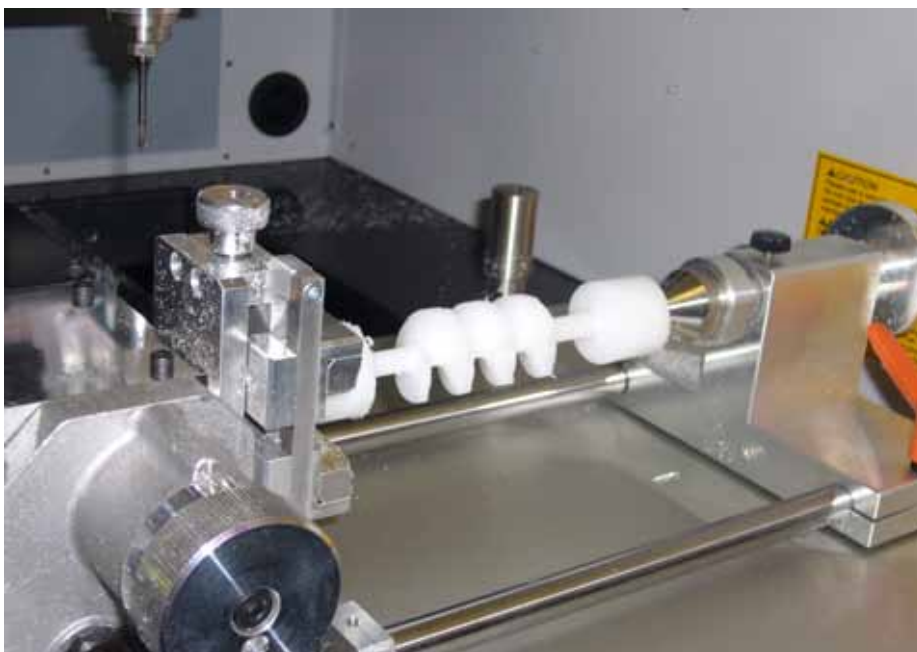
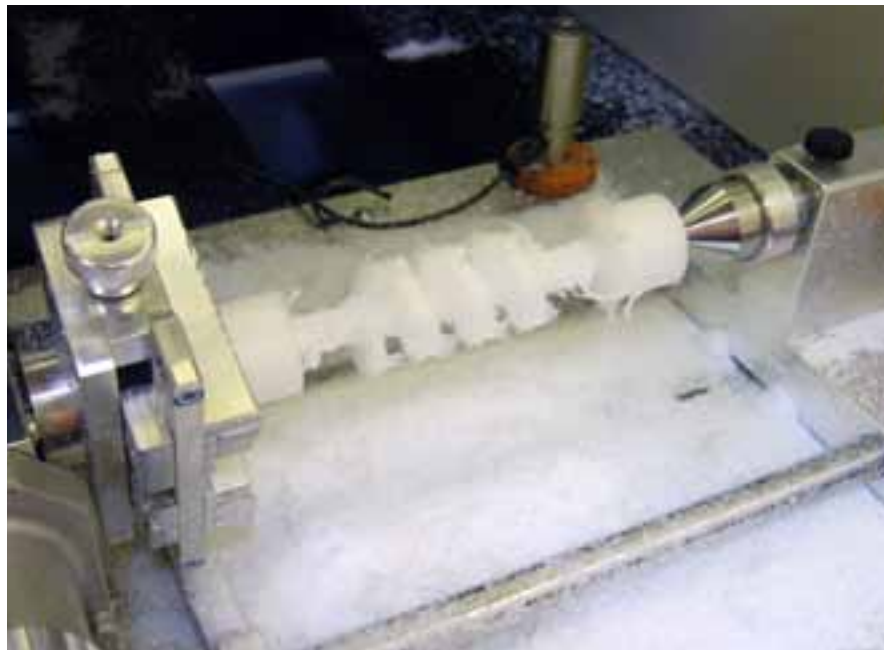


Photo showing **Finishing** process completed.

~~~~ End of Example 4 ~~~~

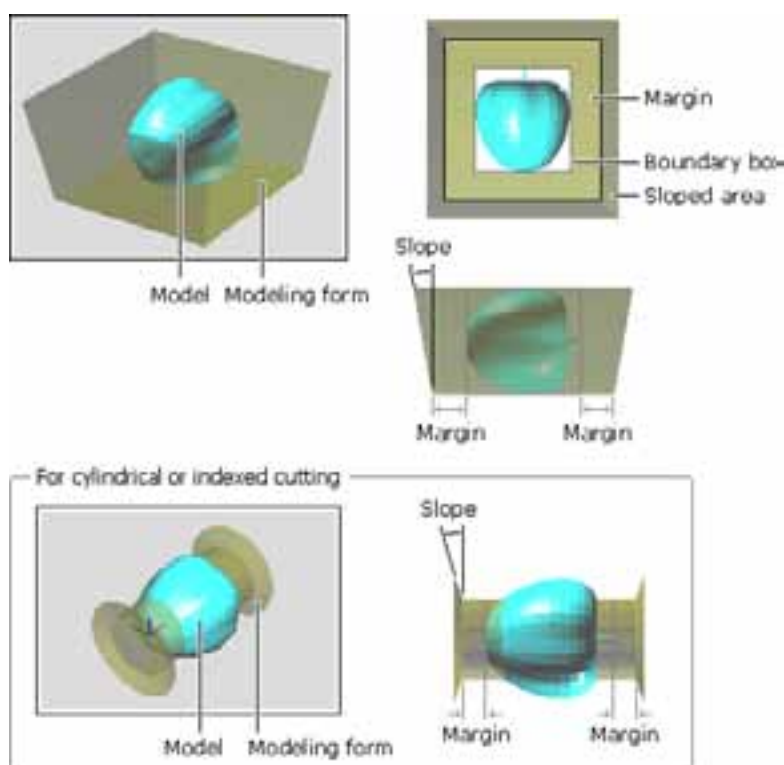
APPENDIX A (detailed explanations)

Basic Concepts

What's a Modeling Form?

The space provided around a model for the approach of the tool is called the modeling form.

In order to cut an entire model, it is necessary to provide, outside the boundary box, a space that is wider than the blade diameter. Also, slopes are made around the margin to eliminate perpendicular walls whose height the tool cannot reach.

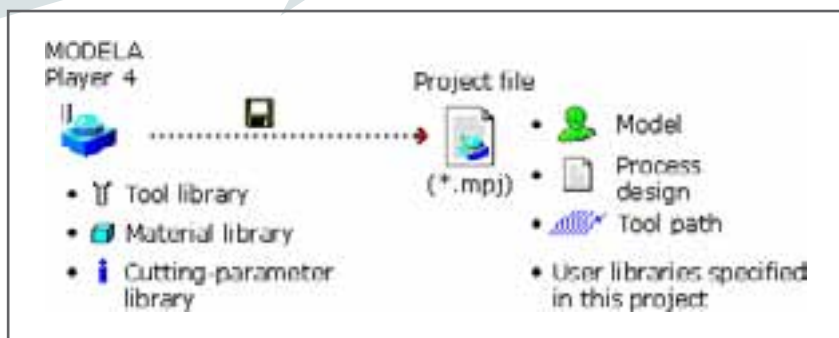


When you are performing single- or multiple-surface cutting, you decide on the modeling form for each cutting surface. The depth of the modeling form is the maximum cutting depth of the cutting surface. The depth of cutting specified in the processes is limited to the depth of the modeling form.

When you are performing cylindrical or indexed cutting, you set the depth of the modeling form at the depth from the circle circumscribed around the model. The depth of the modeling form is the limit for the tool's approach. No tool path is created in the area nearer to the center of the axis of rotation than the depth of the modeling form.

The slope is created rising from the depth of the modeling form to the top edge of the model.

Projects and Libraries



What's a Project?

The format in which MODELA Player 4 saves data is called a “project file.”

The contents of a project file are as follows:

- Model data
- Process design
- Tool-path data
- User libraries specified in this file

Opening a project file re-creates the values that have been saved, including the target cutting machine.

What's a Library?

A database file that is used in cutting a model are called “library.”

Tools and materials that are added are stored in MODELA Player 4 libraries.

Libraries are of the following types:

- Material library
- Tool library
- Cutting parameter library

A library can be classified as either preset library or a user library.

Preset Libraries

These are prepared libraries that come with MODELA Player 4. Their data cannot be deleted or modified.

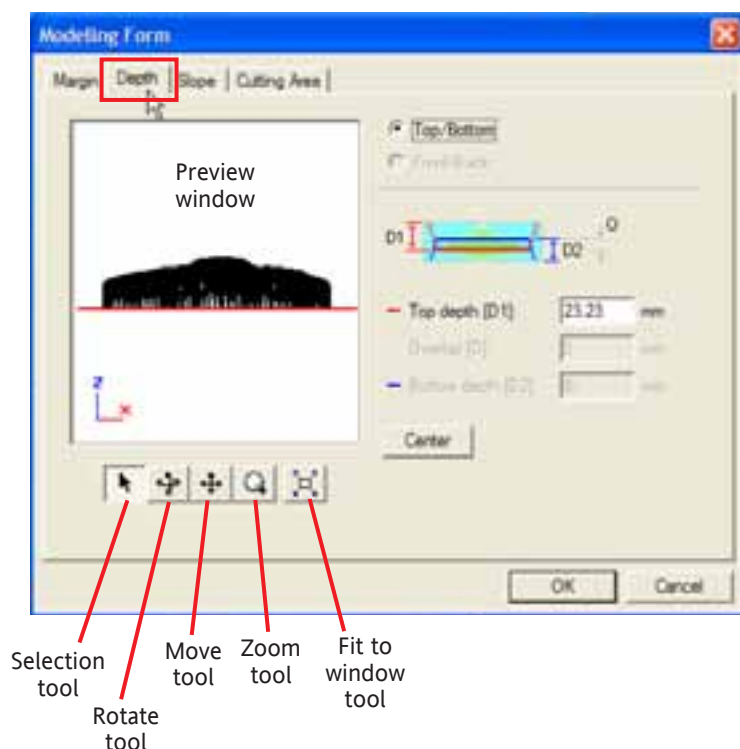
User Libraries

These are libraries that you add later as required. You can delete and modify their data. The user libraries that are used in a project are also saved in the project file.

Note:

Including libraries in a project file lets you re-create the contents of the project, even when you open the file on a different computer. This makes it possible to share the processing work, such as by generating the tool path on one computer and outputting the cutting data on a different computer.

A Depth tab



Overlap - shows the range in which cutting overlaps an opposing surface.

The overlapping range is cut from both surfaces. This is calculated from the cutting depths of the top and bottom (or front and back) surfaces. When the amount of overlap is zero, uncut areas may remain.

Bottom (Back) depth - the cutting depth for the bottom (back) surface. This determines the maximum cutting depth for the corresponding surface. When you're performing multiple-surface cutting, you cannot enter a value that makes the amount of overlap less than zero.

Center
This sets the depth of the top and bottom surface (or the front and back) at the center of the model.

B Tool page



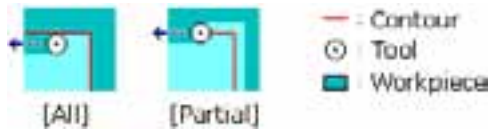
Tool - Choose the tool to use in this process. You cannot choose a tool for which no cutting parameters have been registered. To register cutting parameters, quit this wizard temporarily, then go to **Options > Register Cutting Parameters**.

C New Process Creation - Cutting Area

Cutting Area - This sets the cutting area in the X and Y directions.

When **All** is selected, the tool passes along the inner sides of the contour radii in the area.

When **Partial** is selected, the tool passes along the contours in the area. Note that the tool is restricted from passing beyond the margins.

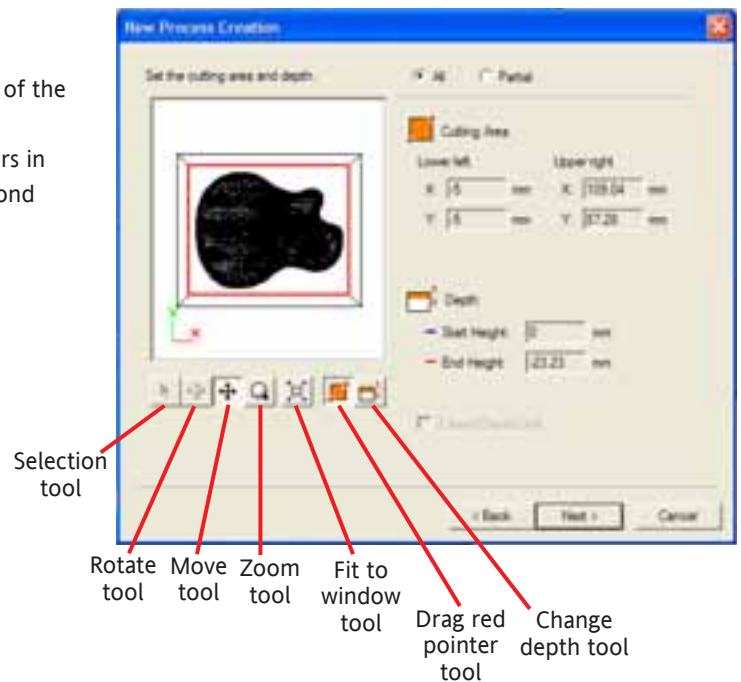


Depth

This sets the upper and lower edges (the ceiling and floor) of the cutting depth.

For **Start Height**, enter the cutting-start height. For **End Height**, enter the cutting-end height.

Enter heights from Z0. If the depth position is lower than Z0, put a minus sign ("-") in front of the value.



Clicking **Partial** to select it allows you to change the area and depths in the preview.

To change the cutting area, follow the steps below.

Click

Click

Drag the red pointer ()

To change only positions without changing the width of the area, drag the inner sides of the red rectangles. To change the depth, follow the steps below.

Click

Click

To change the cutting-start height, drag the blue line ()

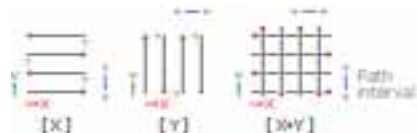
To change the cutting-end height (the bottom), drag the red line ()

To cut deeper than the bottom of the modeling form, select *Extend Depth Limit*. You use this when you want to eliminate all uncut areas at the bottom of the model and create contours.

D New Process Creation - Path Type

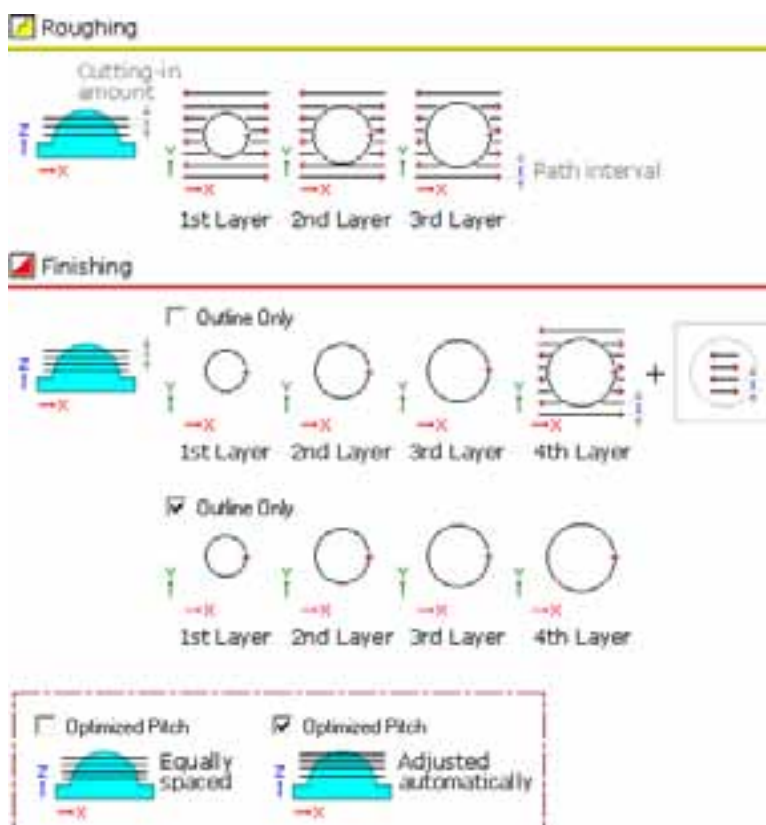
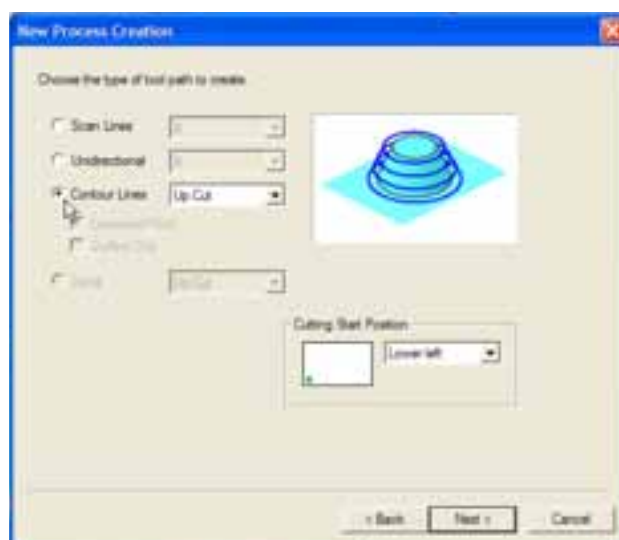
Scan Lines

This creates a tool path parallel to the specified axis. The path is created in such a way that the outbound movement and return movement lie along the axis.



Unidirectional

This creates a tool path parallel to the specified axis. The path is created in such a way that either only the outbound movement or only the return movement lie along the axis.



Contour Lines

This creates a tool path that lies along the contour lines when you're cutting the model into rings on the XY plane.

This is enabled for roughing and finishing. Note, however, that this setting cannot be made when you are performing cylindrical cutting.

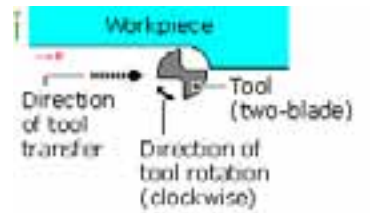
In the finishing process, you can set options for the contour-line finishing path.

Selecting **Optimized Pitch** reduces the cutting-in amount for areas that have a gentle slope.

When paths for areas other than the outline are not needed, select **Outline Only**. When this selection is cleared, scan-line tool paths are created on the flat areas of the model and on the bottom of the modeling form.

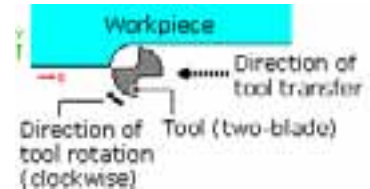
Up Cut

With this cutting method, the direction of tool rotation is identical to the direction of tool movement (transfer).



Down Cut

With this cutting method, the direction of tool rotation is opposite to the direction of tool movement (transfer).



Optimized Pitch

This reduces the cutting-in amount for areas that have a gentle slope, thereby reducing uncut areas. The cutting-in amount is automatically adjusted within a range that does not exceed the specified parameters.

This is enabled only in the finishing process.

Outline Only

This cuts only the outline of the model.

It creates only contour-line tool paths, without creating-scan line tool paths.

This is enabled only in the finishing process.

Spiral

This creates a spiral tool path.

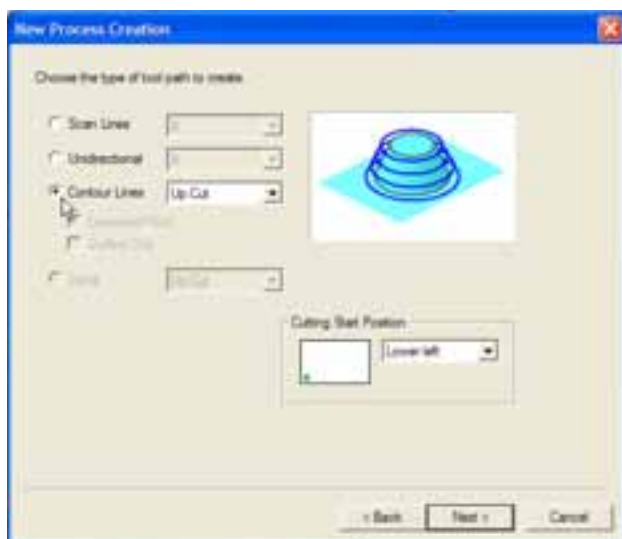
You can make this setting only for the finishing process. Note, however, that this setting cannot be made when you are performing cylindrical cutting.

For information about up cut and down cut, see the description for Contour lines above.

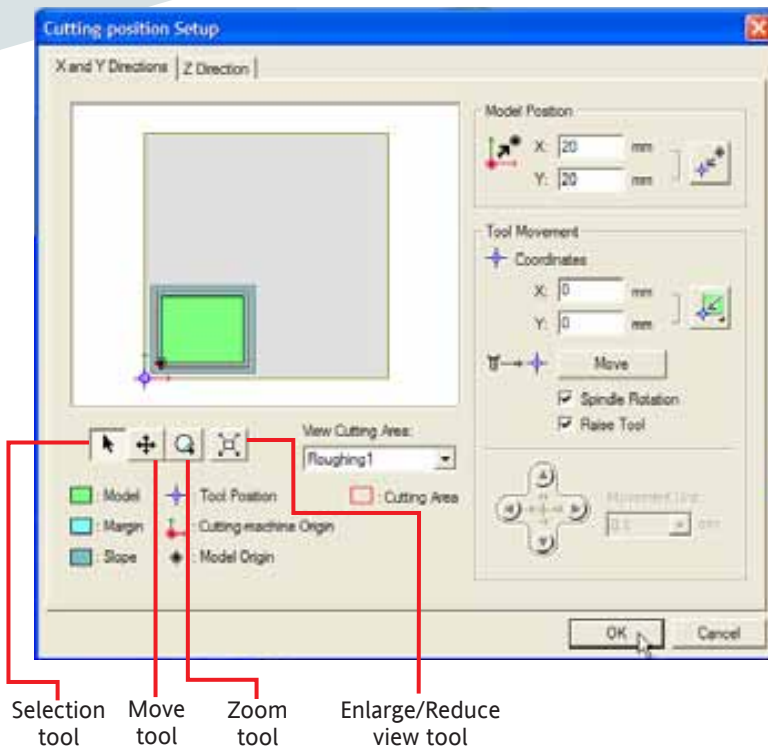


Cutting Start Position

This sets the point at which the tool first approaches the workpiece.



E Cutting Position Setup



Preview

This displays the cutting position of the model in the X and Y directions.

Model Position

This specifies the cutting position of the model in the X and Y directions.

You enter the distances between the cutting-machine origin point and the model origin point. Note that the values you enter are limited by the cutting machine's minimum unit of movement. When you want to determine the cutting position visually, move the tool to the target site and click



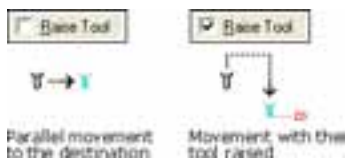
Tool Movement

This moves the tool to the X and Y coordinates you specify.

Enter the coordinate values, then click **Move**.

Note that the values you enter are limited by the cutting machine's minimum unit of movement.

Using  lets you enter coordinates for the four corners and center of the model.



To make the spindle rotate during tool movement, select **Spindle Rotation**.

To make the tool move to the target site without changing the height, clear the selection for **Raise Tool**.

If the tool strikes an obstacle during movement, select **Raise Tool**. When this is done the tool rises to the height limit of the cutting machine, then descends to **Z0** at the target site.

The arrow keys are handy for moving the tool a little at a time near the target site,

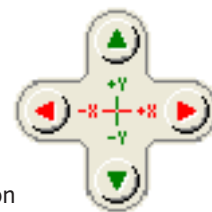
You can move the tool by a relative distance from the present location.

At this time, the spindle does not rotate, and the tool is not raised.

To change the distance moved with each click, click **Movement Unit**.

The arrow keys can be used only when the on-screen tool position matches the tool position on the cutting machine.

To align the on-screen tool position with the tool position on the cutting machine, click **Move**.

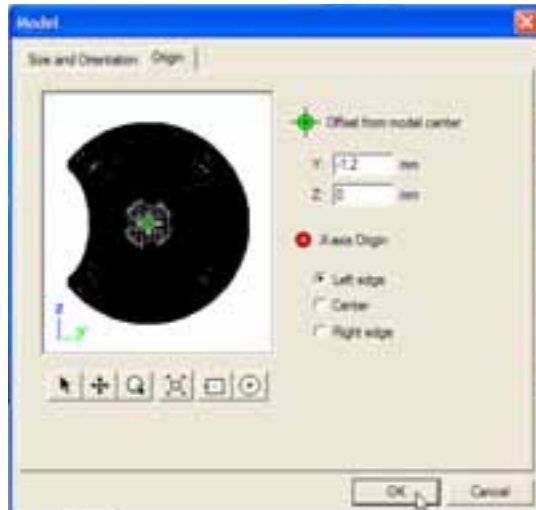


~~~~ End of Appendix A ~~~~

## APPENDIX B (detailed explanations)

### Basic Concepts

#### A Set Model Origin



##### Offset from model center

This sets the location of the model's center of rotation by the amount of offset from the center of the model.


##### X-axis Origin


This sets the X-axis origin point for the model.

##### Preview

This displays the center of rotation of the model.



This lets you set the approximate center of rotation by dragging .

When this is , you can set only the Z-axis location for the center of rotation.



Dragging the model moves it.

This enables you to zoom in by clicking the model. You can specify an area to enlarge by dragging.



Right-click to zoom out.

This enlarges or reduces the view of the model to fill the preview window.




This displays the location of the X-axis origin point.

Dragging  changes the height of the center of rotation.



This displays the center of rotation.

Dragging  changes the location of the center of rotation.

#### B Set Tool-up height

##### Tool-up Height

Make the setting for the tool-up height.

The tool moves at the cutting machine's highest speed (no-load feed) at this height.

Shortening the distances for no-load feed (tool movement with no cutting of the workpiece) can help speed up cutting times.

Enter the value for when the height of the center of rotation is zero.

Set this at a height where the tool is not obstructed by any obstacles.



##### Radius of model's circumscribed circle

Enter the radius of the circumscribed circle for the model at the tool-up height.

To set the tool-up height outside the model, add a numerical value to the radius of the circumscribed circle.

~~~~ End of Appendix B ~~~~